ORIGINAL ARTICLE

The Relationship Between Smartphones Used Before Sleep and Excessive Daytime Sleepiness Among Nursing Students: A Cross-Sectional Study

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ABSTRACT

Introduction: *Smartphone is a communication device that can connect all distances with many features and always update time by time. Students used the smartphone every time to do their activities.*
Objectives: *To explore the relationship between smartphone used before sleep and excessive daytime sleepiness among nursing students.*
Methods: *We used the cross-sectional study. This research sample was nursing students in the first grade in the Faculty of Health Sciences, University of Muhammadiyah Malang. We included 108 respondents by Convenience Sampling (Accidental Sampling) technique. We collected the data by online form. The Spearman correlation test was performed to analyze the data.*
Results: *This research showed that 50.9% of the students were excessive smartphone use before sleep, and 82.4% did not have excessive daytime sleepiness. The Spearman Correlation test analysis results obtained of ρ value = 0.508 indicated no relationship between smartphone used before sleep and excessive daytime sleepiness.*
Conclusions: *Excessive smartphone used at night did not associate with excessive daytime sleepiness among nursing students.*

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1. Introduction

The smartphone is a means of communication both short and long distances. Smartphones are included in spoken and written communication tools that can store messages and are practical to carry anywhere. The smartphone is a wireless communication tool, namely communication that moves without cables, which is said to be a mobile device (Kustiawan, 2016). Along with the development of technology, there are many features on smartphones and updated with the times.

Besides, social media and browsers bring many conveniences for humans. Not only convenience, but smartphones also bring entertainment for children and adults, especially for students, who have many tasks and activities. The use of smartphones cannot be separated from all student activities. Apart from being a means of communication and means of browsing, smartphones are also used as a medium for student entertainment (George & Decristofaro, 2016; Phillippi & Wyatt, 2011).

According to Gusti Yarmi (2017), the use of smartphones among students was mostly used for personal purposes, which interacted more with social media and they used the internet to find information that only took less than an hour. Students mostly use the internet to open social media, entertainment, music, and information, which every day takes more than 3 hours to open

once a day (Greer, Hermanns, Abel, & Njoki, 2019). Besides that, according to research by Exelmans & Van den Bulck, (2016), stated that people use smartphones at night before going to bed to send and receive messages for a relatively long period of time in the dark. Hence, it also affects the quality of sleep.

The use of smartphones, which seems timeless, has many impacts on its users. Nighttime is not a limited time for students to use smartphones. The effect of using a smartphone at night is sleepiness during the day. Research by Mireku et al., (2019) and Ng et al., (2019) stated that the use of smartphones at night before going to bed results in drowsiness during the day, causes pain and poor sleep quality, and if the average smartphone use is more than 68 minutes per day it can cause symptoms of depression. Additionally, the use of a smartphone before bed has a powerful effect on sleep quality. Where a person's sleep time is reduced from average sleep time, or it can be said that the quality of sleep is poor. Because the quality of sleep is poor, it is very influential on the quality of life that is not good, and affects learning motivation.

Research by Heo et al., (2017), mentioned several other effects of using a smartphone at night before sleeping for more than 35 minutes to 1 hour: the decrease in the hormone melatonin due to exposure to blue light from smartphones. Using a smartphone before bed will suppress the release of the hormone melatonin, which stimulates sleep, making it difficult to fall asleep (Calvo-Sanz & Tapia-Ayuga, 2020). With the decrease in the hormone melatonin, the short-term impact is that the brain cycle will be disturbed, and memory slowly decline. In contrast, the long-term impact of melatonin deficiency is the difficulty of developing neurotoxins so that the brain is difficult to develop, and the impact is Alzheimer's disease (Gabel et al., 2013). Besides, the brain will also work slowly to catch and understand new things. The melatonin hormone lacking in the body also has the potential for psychological disorders such as depression and can also cause cancer. Exposure to smartphone light can also cause eye strain, eye irritation, dryness, and blurred eyes (A'yun, 2018).

Result of interviews in October 2019, 15 students of Nursing Science, University of Muhammadiyah Malang, had the habit of using smartphones before going to sleep for several reasons, including doing assignments, playing games, opening social media, sending and receiving messages. Additional results, 75% of students stated that they started sleeping after 11 p.m., and 25% of students started sleeping before 11 p.m. Furthermore, 60% stated that it takes 30-60 minutes to fall asleep, the rest takes more than 60 minutes to fall asleep.

Based on the preliminary interviews with the students, we concluded that some nursing students had the problem in sleep. Their sleep problem started by using excessive of smartphone. Accordingly, we need to investigate this problem. This study aimed to determine the relationship between smartphone used before bedtime and daytime sleepiness among students. Knowledge about the relationship between smartphone use before bed and drowsiness is very useful and can guide students in regulating their smartphone's daily use. The goal is that students can maintain good health and have good quality sleep.

2. Methods

The design of this study was a cross-sectional study. We recruited 108 first-grade of nursing students at the University of Muhammadiyah Malang, taken by accidental sampling. Data were collected from February to March 2020 using the Online Questionnaire Form. Data analysis was performed using the Spearman Correlation test with $\alpha = 0.05$ and using SPSS software version 25.

The independent variable was the use of a smartphone before bedtime as measured by a questionnaire that has been tested for validity (p value 0.00 - 0.024) and reliability (Cronbach Alfa 0.851) (Dewi, 2017). The result > 20 indicated excessive smartphone use.

The dependent variable was the incidence of drowsiness measured by Epworth Sleepiness Scale (ESS). The ESS questionnaire validity test result in Bahasa Indonesia stated that all items

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were valid (r≥ 4) and reliable (Bambangsafira & Nuraini, 2017). Students who have a total ESS score > 10 were considered to have excessive daytime sleepiness (Marta et al., 2020).

3. Results and Discussion

The following table was the characteristic of the respondents according to sociodemographic.

Table 1. Characteristic of the respondents

Characteristics	Frequency (n)	Percentage (%)
Gender		
a. Man	17	15.7
b. Women	91	84.3
Total	108	100.0
Age (Years)		
a. 18 years	39	36.1
b. 19 years old	55	50.9
c. 20 years	12	11.1
d. 21 years	2	1.9
e. 22 years	0	0
Total	108	100.0
Own a Smartphone		
a. Yes	108	100.0
b. Not	0	0
Total	108	100.0

Table 1 showed that the most of respondents were female (84.3%), aged 19 years old (50.9%), and 100% students owning smartphones.

In this research, we measured the prevalence of respondents' smartphone used. Figure 1 showed that smartphone used before bed were in the low category (49.1%) and 50.9% were in the excessive use of smartphones before sleeping.

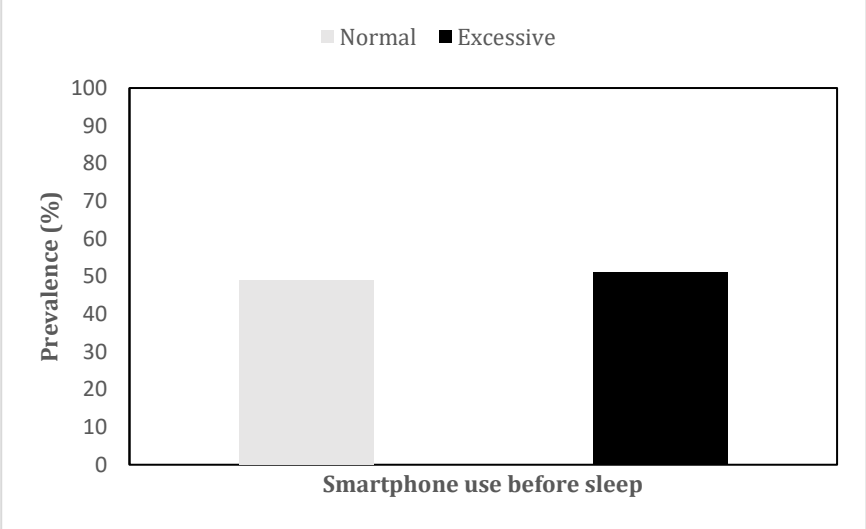

Figure 1. The distribution of smartphone used before sleep among nursing students

Based on Figure 2, most the respondents fell into the normal category, as many as 82.4%, and as many as 17.6% experienced excessive sleepiness during the day.

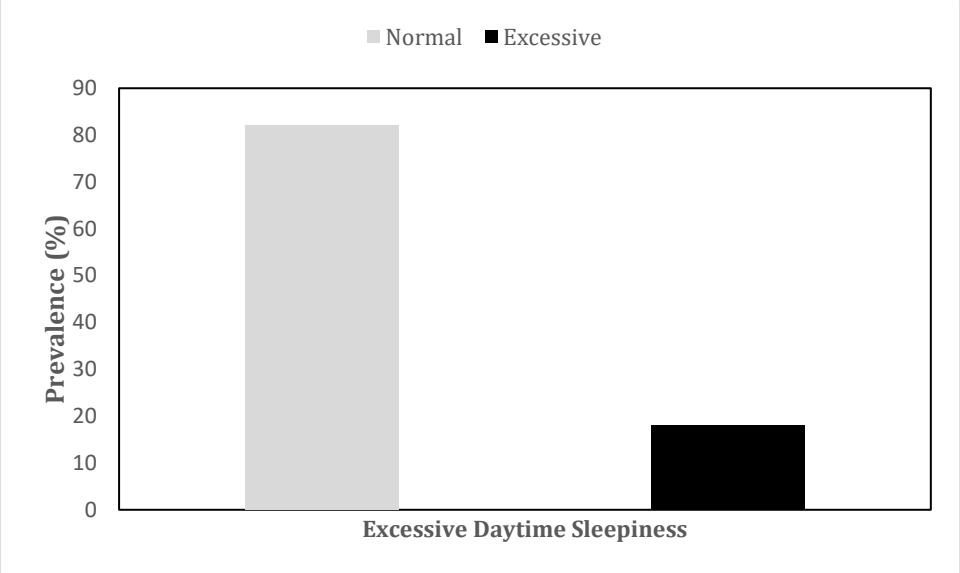

Figure 2. The distribution of excessive daytime sleepiness among nursing students

As shown in Table 2, we analyzed the relationship between smartphone used before bed and the incidence of daytime sleepiness among nursing students. The statistical test result obtained a value of ρ value of 0.508, indicated that there was no relationship between smartphone used before bedtime and daytime sleepiness in nursing students.

Table 2. The relationship between smartphone used before bed and daytime drowsiness

		EDS incident			ρ *value*
Smartphone used before bed		Normal n (%)	Excessive sleepiness n (%)	Total n (%)	p = 0.508 (r = 0.064)
	Normal	45 (84.9)	8 (15.1)	53 (100)	
	Excessive	44 (80)	11 (20)	55 (100)	
Total		89 (82.4)	19 (17.6)	108 (100)	

This college-based research aimed to determine whether there was a relationship between smartphone used before bed and the incidence of daytime sleepiness among nursing students. This study found that the prevalence of excessive use of smartphones before sleeping was 50.9%, and only 17.6% of students experienced excessive daytime sleepiness. The relationship analysis found no significant relationship between the use of smartphones before going to bed with the incidence of daytime sleepiness among nursing students.

Smith et al., (2020) explained that respondents used smartphones before bed to use social media, sent and received messages. This was in line with our research result. The respondents used the smartphone to watch movies or videos, play video games, communicate via telephone, chat, and online on social media.

Based on the study results, the incidence of drowsiness during the day of the majority of respondents was in the normal category. According to Bambangsafira & Nuraini (2017), Excessive Daytime Sleepiness (EDS) is a symptom arising from the tendency to feel excessive sleepiness during the waking period, where EDS is also a neurological disorder that causes excessive daytime sleepiness. The EDS is caused due to several factors, including watching movies or videos, communicating via telephone, SMS, chatting, online on social media, receiving messages or calls before bed, and sending messages/ calls before going to bed either when the lights are on, or the lights are off (Wilson, Reid, Braun, Abbott, & Zee, 2018). The use of a smartphone before bed has

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an effect on the incidence of drowsiness during the day. This is in line with the results of the study, which stated that respondents experience quite a lot of possibility to fall asleep while watching television, video, and movies.

Johansson, Petrisko, & Chasens (2016) explained that the use of social media, watching videos, playing games, communicating via text messages, making or receiving phone calls were all factors that were significantly associated with daytime drowsiness. Besides that, according to research by (Smith et al., 2020), it was also explained that the factors that were very influential with the incidence of sleepiness were online using social media and sending or receiving messages.

Based on the research of Bhat, Pinto-Zipp, Upadhyay, & Polos (2018), the user of a smartphone, used the smartphone before bed to go online on social media, sent messages, received messages, made the call, had an insignificant relationship with the incidence of drowsiness during the day. Several factors that influenced this phenomenon were age, gender, and ethnicity. Supported by a research of Polos et al., (2015), which explained that the incidence of drowsiness decreases with age and usually occurred more frequently in girls. Whereas getting older, the incidence of drowsiness during the day also decreases. According to research by Exelmans & Van den Bulck (2016), there was no relationship between smartphone use before bed and the incidence of drowsiness during the day, even though the quality of sleep was in the poor category. The use of smartphones before bed was related to age and fatigue, so respondents chose to delay their waking time from the usual time.

Hershner & Chervin (2014) explained that physiologically sleep in adolescents and young adults prefer delayed circadian rhythms and have nocturnal habits. These changes occurred in association with puberty, where physically more mature adolescents prefer delaying sleep and have lower homeostatic sleep drives and consequently less sleepiness at night. Supported by the use of technology such as smartphones, computers, music devices, and video games, where smartphones before bed will suppress the hormone melatonin, which can delay sleep time.

The research of Hershner & Chervin (2014) also explained that the use of smartphones before bedtime suppresses the hormone melatonin. Where the light from the smartphone itself affects the hormone melatonin, resulting in sleep delay. To overcome drowsiness, someone often drinks beverages containing caffeine and energy drinks.

Inadequate sleep hygiene also contributed to poor sleep behavior (Ahsan, Kapti, & Putri, 2015; Kapti & Putri, 2016). One example of good sleep hygiene included a regular sleep and wake schedule, a quiet environment, avoiding caffeine after lunch, and other stimulating activities before bed. However, the use of a smartphone before sleep was included in insufficient sleep hygiene, which affects sleep (Al-Kandari et al., 2017; Irish, Kline, Gunn, Buysse, & Hall, 2015; Yazdi, Loukzadeh, Moghaddam, & Jalilolghadr, 2016).

According to Wade & Travis (2008) and Haregu et al., (2015) explained that each individual's circadian rhythm is different due to genetic factors. When viewed from the bivariate analysis result, there were respondents with excessive smartphone use but did not experienced daytime sleepiness and vice versa who minimal use of smartphone but experienced daytime sleepiness, because a person's circadian rhythm was different. There are also possibilities for respondents to prevent drowsiness by drinking beverages containing caffeine. Even though smartphone used was in the excessive category, drowsiness was included in the normal category.

4. Conclusion

In this study, in the category of smartphone use before sleeping, most of the respondents were in the excessive category. In contrast, for the incidence of excessive sleepiness during the day, most of the respondents were in the normal category. This study also found no significant

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relationship between the use of smartphones before bed and the incidence of daytime sleepiness among nursing students.

Nurses as nursing care providers need to pay attention that the smartphones used before bed can also cause health problems, especially for students. Nurses have a role as health educators by taking an active role in promoting good smartphone use and good sleep patterns. Nurses can contribute as nursing consultant. There will be possibilities of changing someone's behavior if they get support and motivation from health workers.

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