

The Impact of Bedtime Smartphone Usage on Sleep Quality among Undergraduate Medical Students

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ABSTRACT

Context: Smartphone use has surged ever since the COVID-19 pandemic, raising concerns about its impact on daily-to-day activities. Blue light emitted by smartphones is known to disrupt melatonin production and adversely affect circadian rhythms, which can potentially affect the health and academics of future doctors.

Aims: This study aims to assess the prevalence of bedtime smartphone use among medical students and its impact on their sleep quality. **Settings and Design:** The research was a cross-sectional study involving 302 undergraduate medical students at a medical college.

Materials and methods: Data were collected via a pre-tested, semistructured Google Forms questionnaire. The questionnaire covered demographic details, patterns of smartphone use, and sleep quality measured using the Pittsburgh sleep quality index (PSQI).

Statistical analysis used: Descriptive statistics and odds ratios were calculated using SPSS software, with significance determined at $p < 0.05$.

Results: A significant portion (92.05%) of students reported using smartphones at bedtime, mainly for social media activities. Prolonged smartphone use, especially for over 60 minutes before sleep, was strongly linked to poor sleep quality (OR = 33.92, $p < 0.001$).

Conclusions: Frequent and extended use of smartphones before bed is associated with poorer sleep quality among medical students. Educational programs focusing on digital and sleep hygiene could improve sleep quality and, consequently, student health and academic performance.

Clinical significance: There is a high prevalence of bedtime smartphone use among medical students, which is correlated with poor sleep quality. Longer smartphone usage durations before sleep increase the risk of sleep disturbances, which can subsequently lead to a myriad of health problems in the future. Educational initiatives promoting digital hygiene could be beneficial.

Keywords: Bedtime smartphone use, Daytime sleepiness, Digital hygiene, Health impacts, Medical students, Pittsburgh index, Smartphone, Sleep quality.

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INTRODUCTION

The melding of smartphones in our daily lives in these recent years has brought about a significant change in our lifestyle by offering easy accessibility, affordability, and an array of limitless functionalities. This technological revolution has been especially underscored during the COVID era, following which technology and gadgets have become indispensable in our daily lives. However, this sudden and expansive incorporation of smartphones into our daily routine has raised a new concern. The excessive dependence on these devices has emerged as a "lifestyle pandemic." Studies have highlighted that the blue light emitted from smartphones, computer screens, LED lamps, LCDs, and various other sources, which has a wavelength of 460 nanometers, and it can profoundly affect sleeping patterns by suppressing melatonin production and subsequently, detrimentally affecting our circadian rhythm.¹ This considerable surge in the usage of smartphones has resulted in a decline in the quality of sleep, especially among young adults and medical students. Research indicates that medical students, in particular, experience a significantly higher prevalence of poor sleep quality compared to other student groups.² Sleep is not just a matter of comfort; it's an essential physiological activity with critical implications for normal metabolic functioning, memory processing, immune system repair, and more. Sleep deprivation and poor sleep quality can lead to a plethora of health issues, including vision disturbances, an increased risk of cardiovascular diseases, obesity, diabetes, and insulin resistance.^{3,4} This overdependence

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on smartphones has drawn comparisons to addiction, with people exhibiting symptoms of dependency like anxiety and irritability when their smartphones are inaccessible. Increased smartphone usage has also been linked to decreased productivity and lower academic performance among students. Studies even suggest that those who lean toward smartphone addiction are more likely to experience poor sleep quality, creating a vicious cycle that further hampers their productivity.^{5,6} In this era of unprecedented connectivity and technology, it's crucial to examine the profound impacts of our smartphone-centric lives on our well-being, both physical and psychological. This multifaceted issue sparks concerns about how to strike a healthy balance between the incredible advantages of smartphone technology and the need

for a restful and healthy night's sleep. This study aimed to evaluate the extent of bedtime smartphone usage among MBBS students at a teaching hospital in central Rajasthan and its implications on sleep quality. The primary objectives were to gauge the prevalence of smartphone use at bedtime and to explore the potential links between such usage and the overall quality of sleep among the students.

MATERIALS AND METHODS

Study Design

A cross-sectional approach was employed to investigate smartphone usage and its impact on the sleep quality of MBBS students at a teaching hospital in central Rajasthan. Initially, 310 students filled out the form. However, we excluded eight participants from the analysis as six were under 18 years of age and two did not own smartphones. Therefore, 302 MBBS students were included in the study, which was conducted during the month of November 2023, following clearance from the institutional ethical committee.

Sample Collection

Data collection was carried out using Google Forms, which consisted of a pre-tested, semistructured questionnaire in the English language. The questionnaire was categorized into three parts, incorporating demographic data, smartphone usage patterns, and the Pittsburgh sleep quality index (PSQI).⁷ Informed consent was obtained from all participants before beginning of the questionnaire.

Demographic Data

This section was designed to collect basic demographic information about the participants and included questions related to age, gender, academic year, and present address to help in understanding the profile of the participants.

Smartphone Usage Patterns

The second part of the questionnaire probed smartphone usage habits. This section included questions regarding the frequency and duration of smartphone usage, specific applications or activities commonly performed on smartphones, and whether smartphones were used before bedtime. These questions aimed to assess the extent and nature of smartphone dependency.

Pittsburgh Sleep Quality Index

The third and the most integral part of the questionnaire was the PSQI, which is a standardized tool designed for evaluation of sleep quality of individuals. It was administered to evaluate the study subjects' sleep patterns and quality over the preceding month. Responses were primarily recorded on a four-point Likert scale to enable the assessment of seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Total PSQI scores range from 0 to 21, with higher scores signifying a heightened degree of sleep-related concerns. A global PSQI score equal to or exceeding 5 signified the presence of poor sleep quality experienced by the subjects throughout the preceding month.⁸

Statistical Analysis

Data were recorded using Google spreadsheets and MS Excel, and statistical analysis was done on PSPP 1.6.2. Data cleaning

Table 1: Demographic distribution of the study population

	Number of students	Percentage of students (%)
Age		
18–20 years	101	33.44
20–22 years	143	47.35
22–24 years	46	15.23
>24 years	12	3.97
Sex		
Male	178	58.94
Female	124	41.05

Table 2: Bedtime smartphone use among the study population

Smartphone use at bedtime	Number (N = 302)	Percent
Yes	289	92.05
No	13	7.95
Number of times of bedtime smartphone use/month	Number (N = 289)	Percent
<= 3 times in a month	4	1.38
Once a week	7	2.42
Several times in a week	52	17.99
Everyday	226	78.20
Smartphone usage at bedtime in min/day	Number (N = 289)	Percent
<= 15	86	29.75
16–30	102	35.29
31–60	58	20.06
>60	43	14.87

was done before analysis. Descriptive statistics were presented as numbers and percentages. Odds ratios were calculated to determine the risk of poor sleep quality associated with varying durations of smartphone usage, with confidence intervals set at 95% and a significance level of $p < 0.05$ considered statistically significant.

RESULTS

Demographics

Among the 302 participating students, approximately 48% fell within the age range of 20–22 years, as indicated in Table 1. A significant majority, or 58.9% of the respondents, were male. Regarding their academic status, 49% of the participants were in their 3rd year of professional MBBS studies, while 36.9% were enrolled in the 1st year. A minor portion, precisely 14.56%, were native to Ajmer and lived with their family. 51.32% lived in the hostel, and 34.20% lived in rented accommodations were paying guests. Importantly, none of the respondents had received a clinical diagnosis of any sleeping disorder.

Prevalence of Smartphone Usage at Bedtime

A significant 92.05% of the participants reported utilizing their smartphones at bedtime, highlighting the prevalent and widespread nature of this practice. Among the various purposes for bedtime smartphone usage, social media emerged as the most prominent, with 43.94% of students engaging in social media activities before sleep. Table 2 provides a detailed breakdown of the prevalence and extent of smartphone use before bedtime (Fig. 1).

Notably, a substantial portion (35.29%) used their smartphones for a duration of 16–30 min before falling asleep. These findings underscore the extensive reliance on smartphones, particularly for social media engagement, as an integral part of the bedtime routine among the student population.

Sleep Quality

The majority of respondents reported their bedtime between 12 and 1 a.m., with an average sleep duration of 6–7 hours over the past month. Notably, nearly half (48.6%) had a sleep latency time of 10–15 min, signifying a relatively efficient transition into slumber. Impressively, a significant 66.6% of respondents considered their sleep quality in the past month to be fairly good. During this period, the vast majority (90.7%) did not require any medication to initiate sleep, while 6.3% resorted to medication at least once a week to facilitate sleep onset. Additionally, 51.3% of students reported not sharing their sleeping space with a roommate or bed partner. The Global PSQI, outlined in Table 3, reveals that approximately 47% of students achieved a commendable level of sleep quality based on the index’s assessment, reflecting the diverse sleep patterns and habits observed among the study participants.

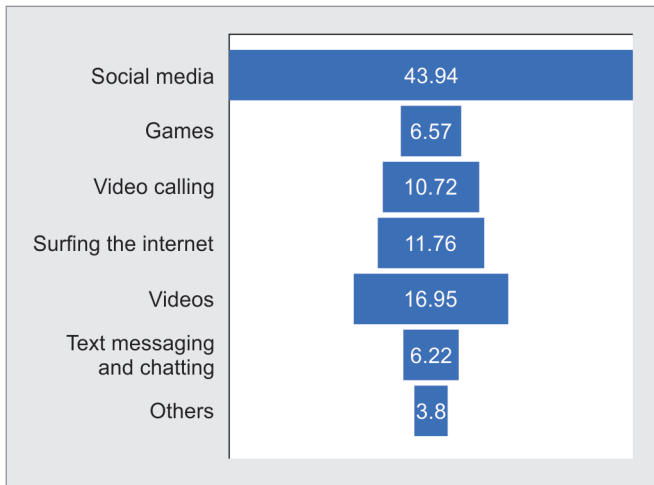


Fig. 1: Smartphone services used at bedtime

Table 3: Global Pittsburgh sleep quality index scoring

Global PSQI score	Number of students	Percentage of students (%)
≤5	142	47.01
>5	160	52.98

*NOTE: ≤5 indicates good sleep quality and a score >5 indicates poor sleep quality

Subjective Daytime Dysfunction

Among the participants, a notable 90.65% acknowledged experiencing daytime dysfunction as a consequence of late-night smartphone usage. Figure 2 shows that within this group, a substantial 38.54% reported dealing with excessive daytime sleepiness, while 17.93% indicated that their late-night smartphone use adversely impacted their productivity on the following day. These findings underscore the real-world consequences of nighttime smartphone engagement on participants’ daily functioning and overall well-being.

Bedtime Smartphone Usage and Sleep Quality

Table 4 indicates that participants who used smartphones for 15 min or less before bedtime had a 2.5 times higher risk of poor sleep quality compared to non-users. This risk increased to about 4.9 times for those using smartphones for 16–30 min. Students who used smartphones for over 30 min at bedtime faced a significant 21-fold increase in the risk. Moreover, when smartphone use exceeded 60 min, the risk significantly surged, with a 33.92-fold increase in the likelihood of experiencing poor sleep quality.

Limitations

The assessment of sleep quality in our study was based on self-reported data, which is subjective and may be susceptible to recall bias. Objective markers such as polysomnography and melatonin levels must be used in future studies in this area to provide a more thorough and accurate evaluation of sleep quality. As this was a cross-sectional study, only snapshot observations could be made. Longitudinal studies offering a more in-depth analysis of

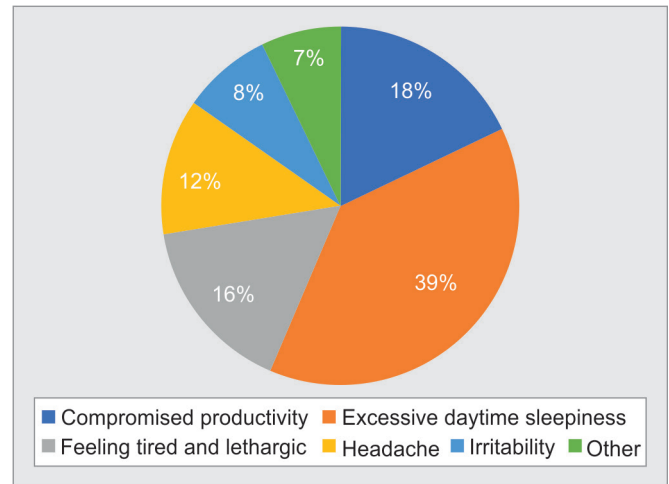


Fig. 2: Subjective daytime dysfunction after late night smartphone use

Table 4: Odds ratio for sleep quality and time spent using smartphone at bedtime among undergraduate medical students (N = 302)

Time spent using smartphone at bedtime	Sleep quality		Odd's ratio	95% Confidence interval	p-value
	Good	Bad			
Do not use	11	2	1		
≤15 min	59	27	2.5169	0.5216–12.1461	0.25
16–30 min	54	48	4.8889	1.0315–23.1724	0.046
31–60 min	12	46	21.0833	4.1098–108.1580	<0.001
>60 min	6	37	33.9167	5.9764–192.4814	<0.001

this topic are required. Furthermore, as this study was conducted with a relatively small sample size, there can be limitations about the generalizability of the findings. Analysis of a diverse and larger sample is recommended to enhance the reliability of results. It is also essential to note that factors beyond smartphone use, such as psychological, social, and behavioral aspects, can also contribute to sleep disturbances that have not been taken into consideration in this study. Future studies should consider other mediating variables that can affect sleep quality to provide a more comprehensive outlook on this problem. Although we have found a clear association between smartphone use at bedtime and poor sleep quality, we do not know whether poor sleep quality leads to the use of a smartphone or the other way round. Further research is needed to completely understand the role of smartphones in causing poor sleep quality.

DISCUSSION

As per the National Sleep Foundation Guidelines, a young adult aged 18–25 years requires 7–9 hours of sleep every night.⁴ We observed that 58% of the respondents slept for 6–7 hours at night, whereas Datta et al. in their study conducted in Tripura observed 70.9% slept for 4–6 hours at night during college working days.⁹ Giri et al. found that 68% of medical students of a medical college in Maharashtra slept for 6–7 hours.¹⁰

In our study, 92.05% used their phones at bedtime, with 35.29% using it between 16 and 30 min and 43.94% using it for browsing social media. 52.98% were poor sleepers as per PSQI. Around 6.3% reported having taken medication at least once to initiate sleep in the past week. Students using phones for >60 min at bedtime were at 33.92 times increased risk of being poor sleepers. Similar observations have been reported by Krishnan et al., who reported that those using smartphones for more than 2 hours at bedtime tend to have increased sleep latency, reduced sleep duration, sleep inefficiency, and increased daytime sleep disturbances.⁵ Datta et al. reported 37.9% used their phone before sleeping.⁹ The study by Giri et al. also suggested a strong positive correlation between bedtime smartphone use and poor sleep quality.¹⁰ Nowreen and Ahad conducted similar research among medical students of Jammu and Kashmir, where 34.4% of students were reported to have smartphone addiction, while 50.9% were using it for browsing social media, and 62.7% were poor sleepers.¹¹

In our study it was observed that 90.65% reported some sort of daytime dysfunction, with the majority of them suffering from excessive daytime sleepiness and 17.93% reporting decreased productivity. Krishnan et al. also found that among the students who use their phone at bedtime for more than 2 hours, 14.89% had reported very severe daytime dysfunction problems, when compared to 9.82% in group I. Difficulty in engaging in daily activities was the most common daytime dysfunction.⁵ Sohn et al. did a similar study in the UK, where young adults who used smartphones for more than 3 hours reported to have 48.4% smartphone addiction. Using a phone at bedtime was associated with poor sleep quality and subsequently with significant daytime dysfunction. Smartphone use at 1 a.m. or later was associated with a four times increased risk of smartphone addiction.⁶ In the study by Datta et al. 87.2% reported daytime sleepiness.⁹ Alshobaili et al. conducted a similar study in Saudi Arabia that reported that about 43% of participants who use their smartphones at bedtime think that it does not affect them the next day, while 37.4% do not know if it affects them or not. Of those who think that bedtime usage of

smartphones affects them the next day, 63% think that they get tired the next day, while about 40% report having a headache.¹²

CONCLUSION

In conclusion, our study has highlighted the harmful consequences of screen time exposure at bedtime on sleep quality and daytime functioning among medical undergraduate students. The association between smartphone usage at bedtime and poor sleep quality is established, with a more pronounced impact observed when the duration of smartphone usage exceeds 60 min. These results underscore the importance of recognizing the potential risks associated with prolonged smartphone use before sleep. Such habits may predispose students to poor sleep quality and increased daytime dysfunction. The findings of our study emphasize the need for interventions and educational initiatives aimed at promoting healthy sleep practices, particularly among young adults and medical undergraduates, in particular, to ensure their well-being and academic performance. Promoting digital literacy and fostering a balanced use of technology are essential components of addressing the challenges associated with increased use of technology. Equipping individuals with the knowledge and skills to make informed choices regarding their digital habits can help to mitigate the potential negative impacts on sleep quality and overall well-being. Striking a balance between the benefits and potential drawbacks of technology is key to maintaining a healthy and productive lifestyle, especially in the context of academic demands.

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