

## Original Research Article

# Effects of bedtime smartphone use on sleep quality among medical students: a cross-sectional study

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## ABSTRACT

**Background:** Sleep is essential for physical, mental, and cognitive health, especially among medical students facing academic pressure. However, bedtime smartphone use is increasingly disrupting sleep quality through blue light exposure and psychological stimulation. This leads to delayed sleep onset, reduced sleep duration, and daytime dysfunction. Despite growing concerns, limited research exists in this area among Bangladeshi medical students, making it important to explore the relationship between smartphone use and sleep quality. Objectives were to assess effects of bedtime smartphone use on sleep quality and its patterns among medical students.

**Methods:** This cross-sectional study was conducted at a medical college in Sylhet Division from August to November 2025 among 100 medical students. Data were collected using a structured questionnaire covering smartphone use patterns and sleep quality (PSQI). Inclusion criteria included students aged 18-26 years using smartphones before sleep. Data were analyzed using SPSS v25, applying descriptive statistics and Chi-square test, with  $p < 0.05$  considered significant. Ethical approval and informed consent were obtained.

**Results:** Among 100 participants, most were aged 21-23 years (46%), with a mean age of  $22.4 \pm 2.1$  years; 52% were male and 72% were MBBS students. Bedtime smartphone use was mainly 1-2 hours (38%), with social media as the most common purpose (42%,  $p < 0.001$ ). Poor sleep quality was observed in 68%, and 36% slept 5-6 hours. Higher smartphone use was associated with worse sleep outcomes and increased daytime sleepiness (78%).

**Conclusions:** Bedtime smartphone use significantly disrupts sleep quality among medical students by affecting circadian rhythm and increasing cognitive stimulation.

**Keywords:** Bedtime smartphone use, Blue light exposure, Circadian rhythm, Medical students, Sleep quality

## INTRODUCTION

Sleep is a fundamental biological process essential for physical health, cognitive performance, and emotional well-being. Among medical students, adequate sleep is particularly important due to the demanding academic workload and the need for optimal concentration and decision-making abilities.<sup>1</sup> However, recent years have witnessed a significant decline in sleep quality among students, largely attributed to lifestyle changes and

increased use of digital devices, particularly smartphones.<sup>2</sup> Smartphones have become an integral part of daily life, offering communication, education, and entertainment. Despite their benefits, excessive smartphone use especially before bedtime has been associated with adverse effects on sleep quality.<sup>3</sup> Exposure to blue light emitted from smartphone screens can suppress melatonin secretion, a hormone that regulates the sleep-wake cycle, thereby delaying sleep onset and reducing overall sleep duration.<sup>4</sup> Furthermore, engaging

in stimulating activities such as social media browsing, gaming, and video streaming before sleep can increase cognitive arousal, making it difficult to fall asleep.<sup>5</sup> Medical students are particularly vulnerable to poor sleep quality due to academic stress, irregular schedules, and frequent use of smartphones for both academic and recreational purposes.<sup>6</sup> Studies have shown that bedtime smartphone use is significantly associated with insomnia, poor sleep efficiency, and increased daytime sleepiness among this population.<sup>7</sup> Additionally, excessive smartphone use has been linked to mental health issues such as anxiety and depression, which further exacerbate sleep disturbances.<sup>8</sup> Globally, the prevalence of poor sleep quality among university students has been reported to range between 40% and 70%, with even higher rates among medical students.<sup>9</sup> In developing countries, including Bangladesh, the widespread availability of affordable smartphones has further increased screen exposure among young adults.<sup>10</sup> Despite this, there remains a lack of sufficient research focusing on the relationship between bedtime smartphone use and sleep quality in medical students in this region.<sup>11</sup> Understanding the impact of bedtime smartphone usage on sleep quality is crucial for developing effective interventions aimed at improving sleep hygiene and overall well-being among medical students.<sup>12</sup> Identifying behavioral patterns and associated risk factors can help in designing targeted awareness programs and institutional policies.<sup>13</sup> Moreover, improving sleep quality may lead to better academic performance, enhanced mental health, and improved clinical competence.<sup>14,15</sup>

## Objectives

### General objective

General objective was to assess the effects of bedtime smartphone use on sleep quality among medical students.

### Specific objectives

Specific objectives were to determine the pattern and duration of smartphone use before bedtime among medical students; to evaluate the sleep quality of medical students; to identify the common purposes of smartphone, use before sleep; to examine the association between duration of bedtime smartphone use and sleep.

## METHODS

This cross-sectional observational study was conducted at a renowned medical college in the Sylhet Division of Bangladesh over a period of three months, from 1<sup>st</sup> August 2025 to 1<sup>st</sup> November 2025. A multiphase sampling technique was used, wherein all 5<sup>th</sup>-year medical students were initially included. In the first phase, students with comorbid psychiatric or medical conditions were excluded. The total population consists of 111 students, and data was collected from 100 students who met the inclusion criteria after exclusions. Permission was

obtained from the medical college authorities, and the study was approved by the institutional ethical review board (IERB) before beginning. Students were notified in advance about the study, and written informed consent was acquired from participants who agreed to participate. The study aimed to assess the effects of bedtime smartphone use on sleep quality among the participants.

Data were collected using a structured, pre-tested, self-administered questionnaire distributed among the participants. The questionnaire included sections on socio-demographic characteristics, bedtime smartphone usage patterns (duration, frequency, and purpose), and sleep quality assessment using a standardized tool such as the Pittsburgh sleep quality index (PSQI). Participants were approached in academic settings and informed about the purpose of the study. After obtaining consent, they were asked to complete the questionnaire anonymously. Completed questionnaires were checked for completeness and consistency before data entry. All 5<sup>th</sup> year medical students of this medical college were currently enrolled who used smartphones regularly, particularly before bedtime, were included in the study. Participants who provided informed consent and were willing to complete the questionnaire were considered eligible for inclusion. Participants were excluded if they had diagnosed sleep disorders, psychiatric illnesses, or chronic medical conditions that could affect sleep quality. Additionally, students who were on medications influencing sleep (such as sedatives or stimulants), those unwilling to participate, or those who submitted incomplete questionnaires were excluded from the study.

Collected data were entered, cleaned, and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize the data. Inferential statistics, including the Chi-square test, were applied to assess the association between bedtime smartphone usage and sleep quality. A p value of less than 0.05 was considered statistically significant.

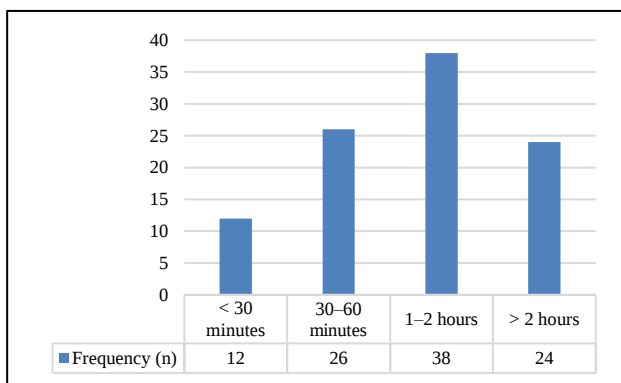
Ethical approval for the study was obtained from the institutional review board (IRB) of the respective medical college prior to data collection. Participation was entirely voluntary, and informed written consent was obtained from all participants. Confidentiality and anonymity of the respondents were strictly maintained, and no personal identifiers were recorded. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki.

## RESULTS

Table 1 shows, out of 100 participants, the majority were aged 21-23 years (46%), followed by 18-20 years (28%) and 24-26 years (26%), with a mean age of 22.4±2.1 years. Male participants constituted 52%, while females accounted for 48%. In terms of occupation, 72% were MBBS students and 28% were intern doctors.

**Table 1: Socio-demographic characteristics of the study population (n=100).**

| Variables          | Frequency      | Percentage |
|--------------------|----------------|------------|
| <b>Age (years)</b> |                |            |
| 18-20              | 28             | 28         |
| 21-23              | 46             | 46         |
| 24-26              | 26             | 26         |
| <b>Mean age±SD</b> | 22.4±2.1 years |            |
| <b>Gender</b>      |                |            |
| Male               | 52             | 52         |
| Female             | 48             | 48         |
| <b>Occupation</b>  |                |            |
| MBBS Student       | 72             | 72         |
| Intern Doctor      | 28             | 28         |



**Figure 1: Bedtime smartphone usage duration.**

Figure 1 regarding bedtime smartphone usage, 38% of participants reported using smartphones for 1-2 hours, followed by 26% using for 30-60 minutes and 24% for more than 2 hours. Only 12% used smartphones for less than 30 minutes before sleep.

**Table 2: Purpose of smartphone use before sleep.**

| Purposes                          | Frequency | Percentage | P value |
|-----------------------------------|-----------|------------|---------|
| <b>Social media</b>               | 42        | 42         | <0.001  |
| <b>Watching videos/ streaming</b> | 28        | 28         | 0.012   |
| <b>Academic study</b>             | 18        | 18         | 0.085   |
| <b>Gaming</b>                     | 12        | 12         | 0.210   |

Table 2 demonstrates that social media was the most common purpose of smartphone use before bedtime, reported by 42% of participants, and this association was statistically highly significant ( $p<0.001$ ). Watching videos or streaming was the second most common activity (28%), also showing statistical significance ( $p=0.012$ ). Academic use accounted for 18% of participants but did not reach statistical significance ( $p=0.085$ ). Gaming was the least common activity (12%) and was not statistically significant ( $p=0.210$ ).

**Table 3: Sleep duration among participants.**

| Sleep durations | Frequency | Percentage |
|-----------------|-----------|------------|
| <5 hours        | 14        | 14         |
| 5-6 hours       | 36        | 36         |
| 6-7 hours       | 30        | 30         |
| >7 hours        | 20        | 20         |

Table 3 shows, in terms of sleep duration, 36% of participants slept 5-6 hours per night, while 30% reported 6-7 hours of sleep. A smaller proportion, 20%, slept more than 7 hours, whereas 14% had less than 5 hours of sleep per night.

**Table 4: Sleep quality assessment (PSQI score).**

| Sleep quality             | Frequency | Percentage |
|---------------------------|-----------|------------|
| <b>Good sleep quality</b> | 32        | 32         |
| <b>Poor sleep quality</b> | 68        | 68         |

Table 4 shows, assessment of sleep quality revealed that 68% of participants had poor sleep quality, while only 32% experienced good sleep quality, indicating a high prevalence of sleep disturbances among the study population.

**Table 5: Association between smartphone usage duration and sleep quality.**

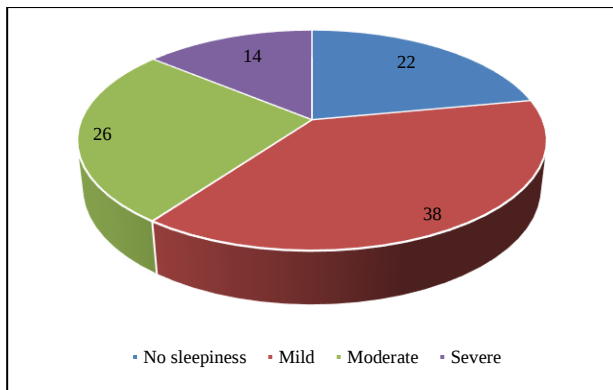
| Usage durations | Good sleep (%) | Poor sleep (%) |
|-----------------|----------------|----------------|
| <1 hour         | 20 (20)        | 18 (18)        |
| 1-2 hours       | 8 (8)          | 30 (30)        |
| >2 hours        | 4 (4)          | 20 (20)        |

Table 5 shows, among participants using smartphones for less than 1 hour, 20% had good sleep quality compared to 18% with poor sleep quality. In contrast, among those using smartphones for 1-2 hours, only 8% had good sleep while 30% had poor sleep. Similarly, among participants using smartphones for more than 2 hours, 4% reported good sleep quality, whereas 20% experienced poor sleep, suggesting a negative association between prolonged smartphone use and sleep quality.

**Table 6: Night-time smartphone checking frequency.**

| Frequency          | Number | Percentage |
|--------------------|--------|------------|
| <b>Never</b>       | 18     | 18         |
| <b>1-2 times</b>   | 34     | 34         |
| <b>3-5 times</b>   | 28     | 28         |
| <b>&gt;5 times</b> | 20     | 20         |

Table 6 shows, night-time smartphone checking was reported as 1-2 times by 34% of participants and 3-5 times by 28%. Additionally, 20% checked their smartphones more than 5 times per night, while only 18% reported never checking their phones during the night.



**Figure 2: Daytime sleepiness among participants.**

Figure 2 shows, daytime sleepiness was reported as mild in 38% of participants, moderate in 26%, and severe in 14%. Only 22% of participants reported no daytime sleepiness, indicating that the majority (78%) experienced some degree of sleepiness during the day.

## DISCUSSION

In the present study, the majority of participants (46%) were aged 21-23 years, with a mean age of  $22.4 \pm 2.1$  years, and a nearly equal gender distribution (52% male versus 48% female). A similar demographic distribution was observed in a recent study where most medical students were within the early twenties age group, reflecting the typical academic stage of medical training.<sup>16</sup> Regarding bedtime smartphone usage, 38% of participants reported using smartphones for 1-2 hours, while 24% used them for more than 2 hours. This high duration of use is consistent with findings from another study where prolonged screen exposure before sleep (>1 hour) was reported by more than half of university students, indicating a growing trend of excessive nighttime device use.<sup>17</sup> In terms of purpose, social media use was predominant (42%), followed by video streaming (28%), both showing statistical significance ( $p < 0.05$ ). Similar findings were reported in another study, where social networking and entertainment were identified as the primary reasons for bedtime smartphone engagement, contributing significantly to delayed sleep onset.<sup>18</sup> Sleep duration analysis revealed that 36% of participants slept 5-6 hours, and only 20% achieved more than 7 hours of sleep. Comparable findings were observed in a June 2023 study, where a majority of students reported sleeping less than the recommended 7-8 hours, highlighting widespread sleep deprivation among medical students.<sup>19</sup> The prevalence of poor sleep quality in this study was notably high (68%). This aligns with another study conducted in mid-2023, which reported that over 60% of medical students experienced poor sleep quality, emphasizing the vulnerability of this population to sleep disturbances.<sup>20</sup> A clear negative association between smartphone usage duration and sleep quality was observed, where increased usage (>2 hours) was associated with higher rates of poor sleep (20% versus 4% good sleep). This finding is supported by another study that

demonstrated a significant relationship between prolonged bedtime screen exposure and poor sleep outcomes.<sup>21</sup> Night-time smartphone checking was frequent, with 34% checking 1-2 times and 20% more than 5 times per night. Similar behavioral patterns were reported in another study, where frequent nocturnal device checking was linked to sleep fragmentation and reduced sleep efficiency.<sup>22</sup> Daytime sleepiness was prevalent in 78% of participants, with 38% reporting mild and 26% moderate sleepiness. A comparable study also found a high prevalence of daytime sleepiness among students with poor sleep hygiene, reinforcing the impact of disrupted sleep on daily functioning.<sup>23</sup>

Despite its important findings, this study has several limitations. Firstly, the cross-sectional design limits the ability to establish a causal relationship between smartphone use and sleep quality. Secondly, the data were collected using self-reported questionnaires, which may be subject to recall bias and social desirability bias.

## CONCLUSION

The findings of this study highlight that bedtime smartphone use plays a significant role in influencing sleep quality among medical students. From a theoretical perspective, excessive use of smartphones before sleep disrupts the natural circadian rhythm through exposure to artificial light and heightened cognitive stimulation. These factors interfere with the body's ability to initiate and maintain restful sleep, ultimately leading to impaired sleep quality and daytime functioning. The study reinforces the concept that modern digital behaviors, particularly late-night screen exposure, act as important modifiable risk factors affecting sleep health.

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