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# The Impact of Nomophobia Levels on Sleep Quality Among Medical Students

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## Abstract

# Objective

This study aimed to determine the prevalence of nomophobia, evaluate overall sleep quality, and analyze the potential impact of nomophobia on sleep profiles alongside various sociodemographic and behavioral factors among medical students.

# Methods

This prospective, descriptive, and cross-sectional study using a stratified sampling method included 307 voluntary medical students enrolled at Muğla Sıtkı Koçman University. Research data were collected via a comprehensive Sociodemographic Form, the Nomophobia Questionnaire, and the Pittsburgh Sleep Quality Index. The obtained data were statistically analyzed using independent t-tests, ANOVA, correlation, and multiple regression analyses.

# Results

Nomophobia was detected in 99.3% of the participants, and 68.1% of them were found to have poor sleep quality. Female gender, smoking habits, and longer daily smartphone usage durations were identified as significant risk factors for poor sleep quality. While global nomophobia scores did not directly correlate with global sleep scores, all individual subscales of nomophobia were significantly associated with specific sleep disturbances.

# Conclusion

Both nomophobia and poor sleep quality are highly prevalent among medical students. Nomophobic anxiety severely disrupts sleep hygiene by causing nocturnal awakenings, thereby necessitating institutional digital detox interventions and sleep hygiene education.

## Introduction

In today's world, smartphones have become an indispensable part of daily life, serving multiple purposes such as communication, information retrieval, entertainment, and learning. However, the uncontrolled and excessive use of these devices has brought about several adverse outcomes, including diminished face-to-face communication, attention deficits, and psychological issues [1]. Currently holding a significant place among non-substance behavioral addictions, smartphones have paved the way for the emergence of new-generation problems, particularly nomophobia, among young users [2,3]. Derived from the English phrase "no-mobile-phone phobia," nomophobia is characterized by an overwhelming sense of anxiety and fear experienced by an individual when they cannot access or are separated from

their smartphone [4]. It is reported that nomophobic tendencies are more prevalent among the younger population, who utilize digital technologies more intensively [5]. This persistent desire to remain online and the resulting digital anxiety caused by nomophobia negatively impact not only individuals' psychosocial processes but also their fundamental biological needs.

Sleep quality, which is of vital importance for maintaining physical and mental health, is directly influenced by digital media consumption habits [6]. Specifically, intense smartphone use prior to sleep disrupts the circadian rhythm through blue light exposure, thereby reducing sleep duration and quality [7]. The literature indicates that individuals with high levels of nomophobia exhibit significantly poorer sleep quality, which subsequently leads to fatigue, impaired concentration, and daytime sleepiness [8,9].

Consequently, alongside the life-facilitating aspects of smartphones, their potential risks to the health of young adults warrant careful investigation. Examining the relationship between nomophobia and sleep quality is of paramount importance for understanding the potential physical and psychological consequences of digital addiction and for developing preventive public health strategies.

# Materials and Methods

### Study Design and Ethical Approval

This prospective, descriptive, and cross-sectional study was conducted among undergraduate medical students (Grades 1–6) at Muğla Sıtkı Koçman University Faculty of Medicine. The study protocol was approved by the University's Medical Sciences Ethics Committee (Date: June 24, 2025; Decision No: 123) and performed in accordance with the Declaration of Helsinki. All participants provided electronic informed consent prior to data collection.

### Participants and Sampling Strategy

The target population comprised 1338 medical students enrolled during the 2024–2025 academic year (Grade 1=281, Grade 2=209, Grade 3=204, Grade 4=269, Grade 5=170, Grade 6=205). Stratified random sampling by grade level was used. The minimum sample size was calculated as 298 using Epi Info 7.0, based on a 95% confidence level, 5% margin of error, and 50% unknown prevalence. Ultimately, 307 eligible students participated voluntarily: Grade 1 (n=68), Grade 2 (n=47), Grade 3 (n=46), Grade 4 (n=59), Grade 5 (n=40), and Grade 6 (n=47).

Inclusion criteria were: (i) age ≥ 18 years, (ii) active smartphone usage, and (iii) completely filling out the survey. Exclusion criteria were: (i) a diagnosed sleep disorder, and (ii) regular use of medications or presence of illnesses affecting sleep patterns. Dropouts or incomplete forms were excluded from analysis.

### Data Collection and Measurement Tools

Data were collected digitally via Google Forms within two months post-ethical approval. The questionnaire package included three sections:

- **Socio-demographic Form:** A 14-item ad-hoc form assessing age, gender, grade, lifestyle habits (smoking/alcohol), living arrangements, medical history, and smartphone habits (daily use duration, peak hours, and urge to check the phone upon waking).
- **Pittsburgh Sleep Quality Index (PSQI):** The Pittsburgh Sleep Quality Index (PSQI), developed by Buysse et al., is a self-report instrument designed to evaluate sleep quality and sleep habits over the past month [10]. The Turkish validity and reliability study of the scale was conducted by Agargun et al. [11]. The scale consists of 18 self-report items grouped into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Each component is scored from 0 to 3, yielding a global PSQI score ranging from 0 to 21. A global score greater than 5 indicates "poor sleep quality," whereas a score of 5 or lower indicates "good sleep quality" [10].
- **Nomophobia Questionnaire (NMP-Q):** The Nomophobia Questionnaire (NMP-Q) was developed to assess the level of anxiety and discomfort experienced by individuals when they are deprived of their smartphones. The Turkish adaptation, validity, and reliability study of the scale was performed by Yildirim et al. [12]. The 20-item scale is rated on a 7-point Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The total score ranges from 20 to 140, where a score of 20 indicates the absence of nomophobia, 21–59 indicates a mild level, 60–99 indicates a moderate level, and 100 or above indicates severe nomophobia. The NMP-Q comprises four subscales: not being able to access information, losing connectedness, not being able to communicate and giving up convenience [13].

**Statistical Analysis**

Data were analyzed using IBM SPSS 27.0. Descriptive statistics were presented as n (%) for categorical variables, and as mean±SD or median (Min-Max) for continuous variables. Normality was assessed via Skewness/Kurtosis, and scale reliability via Cronbach's alpha.

Group comparisons were performed using Independent Samples t-test, Mann-Whitney U, One-Way ANOVA, or Kruskal-Wallis H tests. Post-hoc analyses followed Tukey or Games-Howell tests. Categorical data were analyzed using Pearson's Chi-Square, or Fisher's Exact and Fisher-Freeman-Halton tests when assumptions were violated.

Relationships were evaluated using Spearman's Correlation. Risk factors affecting sleep quality were identified using Multivariable Binary Logistic and Multiple Linear Regression models. Multicollinearity was checked via VIF values. Statistical significance was set at $p < 0.05$.

# Results

The descriptive profile of the participating medical students (n=307) is summarized in Table 1. The participants had a mean age of 21.2 ± 2.3 years, with a median daily smartphone usage of 5.0 hours. The study sample was predominantly male and single. Regarding academic levels, the highest participation was observed among first-year students. In terms of living arrangements, staying in a dormitory with friends and living alone at home were the most frequently reported options.

**Table 1: Descriptive Characteristics of Participants**

| | $\bar{X}$ ± SS | Min–Max | Mdn (Q1–Q3) |
|---|---|---|---|
| **Age (years)** | **21,2 ± 2,3** | 18–29 | 21 (19–23) |
| **Daily smartphone usage time (hours)** | 5,4 ± 2,5 | 1–18 | **5 (4–6,5)** |
| | **Variables** | **n** | **%** |
| **Sex** | Female | 143 | 46.6 |
| | Male | 164 | 53.4 |
| **Marial status** | Single | 303 | 98.7 |
| | Maried | 4 | 1.3 |
| **Grade** | 1st Year | 68 | 22.1 |
| | 2nd Year | 47 | 15.3 |
| | 3rd Year | 46 | 15.0 |
| | 4 th Year | 59 | 19.2 |
| | 5 th Year | 40 | 13.0 |
| | 6 th Year | 47 | 15.3 |
| Chronic disease | No | 286 | 93.2 |
| | Yes | 21 | 6.8 |
| Psychiatric disorder | No | 280 | 91.2 |
| | Yes | 27 | 8.8 |
| Chronic medication use | No | 285 | 92.8 |
| | Yes | 22 | 7.2 |
| Alcohol consumption | No | 181 | 59.0 |
| | Yes | 126 | 41.0 |
| Smoking status | No | 232 | 75.6 |
| | Yes | 75 | 24.4 |
| Living arrangement | At home with family | 53 | 17.3 |
| | At home with friends | 44 | 14.3 |
| | Living alone at home | 88 | 28.7 |
| | Dormitory (Single room) | 16 | 5.2 |
| | Dormitory (Shared room) | 106 | 34.5 |

According to Table 3, participants' bedtime was predominantly concentrated between 00:00 and 01:59, while their wake-up times were mostly between 07:00 and 08:59. The majority of the participants reported within the first 30 minutes. While the mean actual sleep duration was found to be 7.0 ± 1.2 hours, the total time spent in bed was determined to be approximately 40 minutes longer than the actual sleep duration. When the subjective sleep quality of the participants was evaluated, it was noteworthy that sleep dissatisfaction was strikingly high; 94.4% of the students defined their sleep quality as "fairly bad" or "very bad". In contrast to this negative perception, it was determined that 95.1% of the participants did not use any sleep medication  Regarding the impact of sleep problems on daytime functioning, it was found that approximately half of the students had trouble staying awake during daily activities at least 1–2 times a week. Furthermore, this situation was determined to have a negative impact on the ability to maintain enough enthusiasm to get things done at varying levels.

When the reasons for sleep disturbance were analyzed in Table 3"waking up in the middle of the night or early morning" emerged as the most common problem in the sample group, followed by "cannot get to sleep within 30 minutes" experienced at least once a week. Physical factors such as inability to breathe comfortably, coughing/loud snoring, pain, and extreme room temperature were not found to be major sleep-disrupting factors for the vast majority of the participants.

**Table 2: Descriptive Distribution of Participants' Responses to the Pittsburgh Sleep Quality Index (PSQI)**

| | Response Categories | n | % |
|---|---|---|---|
| **Item 1.** Bedtime | 22:00 or earlier | 3 | 1.0 |
| | 22:00–22:59 | 5 | 1.6 |
| | 23:00–23:59 | 46 | 15.0 |
| | 00:00–00:59 | 117 | 38.1 |
| | 01:00–01:59 | 76 | 24.8 |
| | 02:00–02:59 | 37 | 12.1 |
| | 03:00 or later | 23 | 7.5 |
| **Item 2.** Sleep latency | ≤ 15 minutes | 163 | 53.1 |
| | 16–30 minutes | 84 | 27.4 |
| | 31–60 minutes | 43 | 14.0 |
| | > 60 minutes | 17 | 5.5 |
| **Item 3.** Wake-up time | 06:00’ or earlier | 4 | 1.3 |
| | 06:00–06:59 | 28 | 9.1 |
| | 07:00–07:59 | 110 | 35.8 |
| | 08:00–08:59 | 64 | 20.8 |
| | 09:00–09:59 | 53 | 17.3 |
| | 10:00–10:59 | 17 | 5.5 |
| | 11:00–11:59 | 16 | 5.2 |
| | 12:00 or later | 15 | 4.9 |
| **Item 6.** Subjective Sleep Quality | Very good | 1 | 0.3 |
| | Fairly good | 16 | 5.2 |
| | Fairly bad | 191 | 62.2 |
| | Very bad | 99 | 32.2 |
| **Item 7.** Use of sleep medication (prescribed or over-the-counter) | Not during the past month | 292 | 95.1 |
| | Less than once a week | 5 | 1.6 |
| | Once or twice a week | 4 | 1.3 |

| | | | |
|---|---|---|---|
| | Three or more times a week | 6 | 2.0 |
| **Item 8.** Trouble staying awake during daily activities | Not during the past month | 115 | 37.5 |
| | Less than once a week | 46 | 15.0 |
| | Once or twice a week | 77 | 25.1 |
| | Three or more times a week | 69 | 22.5 |
| **Item 9.** Problem maintaining enthusiasm to get things done | No problem at all | 78 | 25.4 |
| | Only a very slight problem | 114 | 37.1 |
| | Somewhat of a problem | 99 | 32.2 |
| | A very big problem | 16 | 5.2 |
| | **$\bar{X}$ +-Std.Sp.** | **Min – Max** | **Median (Q1-Q3)** |
| **Item 4.** During the past month, how many hours of actual sleep did you get at night? Actual sleep time | 7.0 ± 1.2 | 3.8 – 10.0 | 7.0 (6.0 – 8.0) |
| Time Spent in Bed (Hours) | 7.7 ± 1.3 | 4.0 – 12.0 | 7.75 (7.0 – 8.5) |

*** Note:** Detailed frequency and percentage distributions of Item 5 (causes of sleep disturbance), which comprises multiple sub-items, are presented separately in Table 3 due to its specific structural format.

**Table 3: Distribution of Reasons for Sleep Disturbance (PSQI – Question 5)**

| Subscale | Not during the past month n(%) | Less than once a week n(%) | Once or twice a week n(%) | Three or more times a week n(%) |
|---|---|---|---|---|
| **5a –** Cannot get to sleep within 30 minutes | 45 (14.7) | 90 (29.3) | 95 (30.9) | 77 (25.1) |
| **5b –** Wake up in the middle of the night or early morning | 52 (16.9) | 60 (19.5) | 85 (27.7) | 110 (35.8) |
| **5c –** Have to get up to use the bathroom | 123 (40.1) | 71 (23.1) | 64 (20.8) | 49 (16.0) |
| **5d –** Cannot breathe comfortably | 219 (71.3) | 42 (13.7) | 23 (7.5) | 23 (7.5) |
| **5e –** Cough or snore loudly | 232 (75.6) | 39 (12.7) | 21 (6.8) | 15 (4.9) |
| **5f –** Feel too cold | 156 (50.8) | 70 (22.8) | 54 (17.6) | 27 (8.8) |
| **5g –** Feel too hot | 148 (48.2) | 61 (19.9) | 55 (17.9) | 43 (14.0) |
| **5h –** Have bad dreams | 96 (31.3) | 77 (25.1) | 78 (25.4) | 56 (18.2) |
| **5i –** Have pain | 226 (73.6) | 26 (8.5) | 33 (10.7) | 22 (7.2) |
| **5j –** Other reason(s) | 279 (90.9) | 12 (3.9) | 10 (3.3) | 6 (2.0) |

In the study, it was found that the participants' smartphone-related anxieties showed a clear differentiation between the "communication tool" function and the "social media/online identity" function of the device. The highest levels of anxiety were concentrated on basic communication and technical necessities, such as the fear of the phone running out of battery and the fear of being unreachable by family or friends. This indicates that remaining instantly reachable is a major stress factor for the participants.

In contrast, it was determined that the vast majority of the participants did not experience anxiety regarding situations related to online identity and social media updates; indeed, the lowest anxiety scores were mostly reported for instances such as the inability to check e-mails, being unable to stay up-to-date with social media, and being disconnected from online identity. Consequently, it is observed that nomophobic tendencies in the sample group are based on the fear of communication disruption and loss of reachability rather than social media or virtual presence addiction.

Based on the scale scores obtained, the distribution of the participants' sleep quality and nomophobia levels was analyzed. According to the Pittsburgh Sleep Quality Index (PSQI) categories, 68.1% of the participants were found to have poor sleep quality, whereas 31.9% demonstrated good sleep quality (Figure 1). Furthermore, when examining the scores of the Nomophobia Questionnaire (NMP-Q), the majority of the sample exhibited moderate and mild nomophobia levels, followed by severe nomophobia. Conversely, the absence of nomophobia was observed in only 0.7% of the study population (Figure 1)."

Comparative analysis revealed that female students had significantly higher total Nomophobia (72.8 ± 23.9 vs. 65.3 ± 26.0, p=0.009) and PSQI scores (7.6 ± 2.7 vs. 7.0 ± 2.8, p=0.044) than males, showing higher anxiety in "losing connectedness" (p=0.006) and "not being able to communicate" (p=0.001).

Regarding academic years, PSQI scores were similar (p=0.725); however, second-year students experienced significantly higher anxiety. Post-hoc analyses showed that second-year students scored higher than first-year students in "inability to access information" (p=0.029, Games-Howell) and higher than first, third, fifth, and sixth-year students in "losing connectedness" (p=0.004, Tukey). No significant differences were found based on housing status, chronic illness, psychiatric history, or alcohol use.

Continuous medication use was significantly associated with poorer sleep quality (higher PSQI; 8.5 ± 2.7 vs. 7.2 ± 2.8, p=0.029) and higher "not being able to communicate" scores (p=0.036). Smoking students had significantly lower total Nomophobia scores (63.2 ± 23.6 vs. 70.6 ± 25.6, p=0.026) —specifically in "losing connectedness" (p=0.043) and "not being able to communicate" (p=0.024) —but significantly worse sleep quality (PSQI: 8.0 ± 2.8 vs. 7.0 ± 2.7, p=0.006).

Daytime napping was significantly linked to higher PSQI scores (8.1 ± 2.9 vs. 6.8 ± 2.6, p<0.001). Lastly, students who woke up during sleep to check their phones reported significantly higher anxiety in "losing connectedness" (19.4 ± 7.8 vs. 17.0 ± 7.5, p=0.009). The "giving up convenience" subdimension did not differ significantly across any variables.

The results of the Spearman correlation analysis examining the relationships between the variables are summarized in Table 4. According to the analysis results, no statistically significant correlation was found between the Nomophobia Questionnaire Total Score and the Total PSQI Score. Similarly, nomophobia levels (categorical distribution across good/poor sleep groups) had no distinguishing effect on sleep quality classification (p=0.456).

However, when the subdimensions of the PSQI were analyzed in detail, a positive, weak, and significant correlation was determined between the total Nomophobia score and the "Sleep Disturbances" subdimension. Additionally, daily smartphone use duration demonstrated positive and significant correlations with both the total Nomophobia score and the total PSQI score. No significant relationship was found between the age of the participants and either nomophobia or sleep quality.

**Table 4. Spearman Correlation Matrix Between Nomophobia, Sleep Parameters, and Daily Technology Use (n=307)**

| Variables | Inability to Access Information | Losing Connectedness | Not Being Able to Communicate | Giving Up Convenience | Nomophobia Total (NMP-Q) |
|---|---|---|---|---|---|
| Age (years) | 0.10 | -0.04 | -0.03 | 0.04 | 0.02 |
| **Daily smartphone usage time** | **0.31**** | **0.22**** | **0.15*** | **0.26**** | **0.26**** |
| Sleep Duration (hours) | 0.05 | 0.07 | 0.10 | 0.05 | 0.09 |
| Total PSQI Score | 0.079 | 0.060 | 0.058 | **0.114*** | 0.091 |
| C1: Subjective Sleep Quality | 0.032 | -0.016 | -0.018 | 0.001 | -0.002 |
| C2: Sleep Latency | 0.091 | 0.094 | 0.023 | **0.133*** | 0.090 |
| C3: Sleep Duration Component | -0.051 | -0.066 | -0.030 | -0.021 | -0.058 |
| C4: Habitual Sleep Efficiency | 0.066 | -0.010 | -0.047 | 0.067 | 0.002 |
| C5: Sleep Disturbances | **0.123*** | **0.201**** | **0.211**** | **0.236**** | **0.236**** |
| C6: Use of Sleep Medication | 0.048 | -0.032 | 0.028 | 0.051 | 0.034 |
| C7: Daytime Dysfunction | 0.075 | 0.091 | 0.047 | 0.080 | 0.091 |

**Notes:** Spearman correlation analysis was used. Correlation coefficients (r or rho) are presented. Correlation between Total PSQI Score x Sleep Duration (hours): r = -0.49**. * p < 0.05, ** p < 0.01 (Values in bold are statistically significant).

The results of the Multivariate Binary Logistic Regression Analysis, performed to determine the independent risk factors predicting the participants' sleep quality levels (good/poor), are presented in Table 5. The established model was found to be statistically significant (Omnibus $X^2$ = 11.426; p=0.010) and demonstrated adequate fit with the dataset (Hosmer-Lemeshow p=0.865).

According to the model analysis, female gender increases the risk of poor sleep quality by 1.72 times (OR=1.720; 95% CI=1.04-2.84; p=0.034), and smoking status increases it by 2.18 times (OR=2.186; 95%

CI=1.17-4.08; p=0.014). Additionally, each unit increase in daily phone use duration was found to significantly trigger the risk of poor sleep quality (OR=1.172; p=0.011). Conversely, when all other risk factors were controlled, the total Nomophobia score was found to have no independent or decisive predictive effect on the deterioration of sleep quality.

**Table 5:** Logistic Regression Analysis of Factors Influencing Sleep Quality (Good/Poor)

| Variables | **B** | **S.E.** | **Wald** | **p** | **OR (Exp(B))** | **%95 GA (**Lower–Upper**)** |
|---|---|---|---|---|---|---|
| Gender (Female) | 0.542 | 0.256 | 4.483 | **0.034** | **1.720** | 1.041 – 2.840 |
| Smoking status (Yes) | 0.782 | 0.319 | 6.008 | **0.014** | **2.186** | 1.170 – 4.084 |
| Daily Smartphon Usage Time* | 0,159 | 0,062 | 6,545 | **0.011** | **1,172** | 1.038-1.324 |
| Nomophobia Total Score | 0.004 | 0.005 | 0.782 | 0.376 | 1.004 | 0.995 – 1.014 |
| Constant | 0.042 | 0.379 | 0.012 | 0.912 | 1.043 | — |

**Omnibus:** $\chi^2$ = **11.426**, p = **0.010, Nagelkerke $R^2$: 0.051, -2 Log Likelihood:** 373.109, **Hosmer–Lemeshow:** $\chi^2$ = 3.912, p = **0.865**

**Note:** Abbreviations: B: regression coefficient, SE: standard error, OR: Odds Ratio.

Variables: *Continuous variables. Reference categories: a) Male, b) Non-smokers.

# Discussion

In our study, nomophobia was detected in 99.3% of the participants, with 47.2% of the students exhibiting moderate and 13.7% exhibiting severe levels of nomophobia. Notably, the fact that 60.9% of the students suffer from "moderate to severe" nomophobia suggests that the anxiety associated with smartphone deprivation has transformed into a "norm of life" among medical students. The literature indicates that nomophobia is a widespread phenomenon among the younger population. In Turkey, Gezgin and Çakır reported moderate (41.5%) and severe (15.9%) levels of nomophobia among high school students, while Yıldırım et al. reported a 42.6% prevalence of nomophobia among university students [13,14]. A more recent study conducted in Ankara observed nomophobia in all students, with 63.9% at a moderate level and 17.1% at a severe level [15]. Similar high rates are also observed in populations receiving medical education. A study conducted in India found that all medical students exhibited nomophobia, with 67.2% categorized as moderate and 17.3% as severe [16]. Upon reviewing current literature, the 99.5% prevalence of nomophobia (52.3% moderate, 27.7% severe) found in a study by Sadeghi et al. among medical students in Iran largely parallels the findings of our study [17]. These results, which are consistent with both national and international literature, demonstrate that medical students are in a high-risk group for nomophobia. This high prevalence among medical students is thought to stem not only from the need for social connectivity but also from the "necessity" of

smartphones imposed by professional requirements, such as accessing digital course materials during an intensive educational pace, monitoring clinical shifts, and maintaining instant communication within professional groups.

In our study, female students were found to have significantly higher nomophobia scores compared to male students. This finding is largely consistent with existing literature focusing on university samples. Previous studies conducted among university students in Turkey have similarly reported significantly higher levels of nomophobia in females than in males [13,18]. Furthermore, a recent study indicated that female students scored higher not only on the total nomophobia scale but also within the specific subdimensions of "inability to access information" and "loss of connectedness" [19]. In a research focusing specifically on medical students, female gender was directly associated with nomophobia, with female students exhibiting greater anxiety particularly in the "inability to communicate" and "losing connectedness" subdimensions [20]. This higher predisposition to nomophobia among female university students can be explained by distinct patterns in technology usage purposes. It is well-documented that while male students utilize smartphones predominantly for gaming or technical purposes, female students focus more heavily on social communication, instant messaging, and maintaining social networks [21]. The stronger motivation among females to establish social bonds and sustain relationships may intensify the separation anxiety experienced when access to the device is restricted. Moreover, as emphasized by Tuğtekin et al., the more intensive and emotionally driven use of social networks by females increases both problematic smartphone use and social media fatigue [22]. This distinct behavioral pattern may serve as the underlying rationale for the heightened susceptibility to nomophobia observed among female medical students in our study, and the consequently lower sleep quality scores driven by this digital fatigue.

In our study, no significant difference was observed in nomophobia scores based on the participants' living arrangements. This finding contrasts with certain reports in the literature suggesting that students residing in dormitories exhibit higher nomophobia scores [23]. Our result indicates that nomophobia may be driven by internal factors—such as academic stress and digital habits—rather than the physical environment, suggesting that the smartphone has transformed into a primary "living space" independent of geographical location.

When examining academic levels, although overall nomophobia scores were similar across cohorts, second-year medical students exhibited significantly higher anxiety levels in the "inability to access information" and "loss of connectedness" subdimensions compared to other classes. While some studies in the literature reported no significant differences across academic years, others have demonstrated higher levels of nomophobia during the preclinical phase [23,24]. The heightened necessity for instantaneous access to course materials and institutional announcements during the initial years of medical education transforms the smartphone into a vital academic tool. Consequently, this increase observed among second-year students may be evaluated as a situational "compulsion to remain connected" driven by an intensive academic pace, rather than a pathological addiction.

A striking and unexpected finding of this study was that non-smoking students had significantly higher nomophobia levels compared to smokers. This phenomenon can be explained through the lens of the "Behavioral Substitution" hypothesis [25]. Under intense stress, medical students who smoke may utilize nicotine and face-to-face socialization as a coping mechanism, whereas non-smokers might substitute this stress management and dopaminergic reward-seeking behavior through smartphone engagement. Furthermore, because non-smokers lack the routine opportunities to disconnect from screens provided by smoking breaks, their prolonged digital exposure time may subsequently elevate their nomophobia levels.

In our study, the median daily smartphone usage time among medical students was determined to be 5 hours, demonstrating significant positive correlations with both the total nomophobia score and all its subdimensions. While Bartwal et al. reported that 62.1% of medical students used their phones for more than 3 hours a day, identifying this duration as a strong predictor of nomophobia [16], this rate reached a striking 92.5% in our study. The facts that a vast majority of the participants (69.4%) used their phones most intensively during the evening hours, and 44.4% slept after 01:00 AM while maintaining an irregular sleep rhythm, strengthen the hypothesis that this prolonged usage time is sustained by sacrificing sleep. Considering that Mendoza et al. reported that nomophobia negatively impacts attention span and overall learning performance among university students [26], it can be argued that medical students face a dual academic risk driven by both sleep deprivation and cognitive fragmentation.

In our study, 68.1% of the participants were determined to have "poor sleep quality." The findings that more than 60% of the students initiated sleep after midnight and 27.4% experienced a sleep latency exceeding 30 minutes indicate that the sleep health of medical students has reached an alarming level. In the literature, the prevalence of poor sleep quality among medical students has been reported as 53.7% in Iran, 49.7% in France, and 51.3% in India [17,27,28]. Furthermore, a recent meta-analysis reported the overall prevalence of poor sleep quality among medical students to be 55.6% [29]. The higher rate observed in our sample cannot be attributed solely to academic workload; indeed, the fact that 36.2% of the students woke up during the night to check their phones directly demonstrates that sleep hygiene is severely compromised by technological devices. Nocturnal exposure to blue light and subsequent cognitive arousal suppress melatonin secretion, thereby disrupting sleep architecture [30].

When sociodemographic variables were examined, the rate of poor sleep quality among female students was found to be significantly higher compared to males. This finding aligns with the existing literature reporting a higher prevalence of sleep disturbances in females [31]. While this disparity is often associated with hormonal fluctuations and a predisposition to anxiety [32], it may also stem from the tendency of female students to utilize smartphones as an intensive tool for social connectedness that supports their self-esteem [33]. This emotional attachment further impairs sleep quality in females by increasing mental arousal, particularly during nocturnal hours.

The finding that 78.7% of smokers exhibited poor sleep quality, along with the logistic regression analysis demonstrating that smoking increases the risk of poor sleep quality by a factor of 2.18, is

parallel to current literature [34]. While the stimulant effect of nicotine on the central nervous system prolongs sleep latency, withdrawal symptoms arising from declining blood nicotine levels throughout the night trigger micro-arousals, subsequently reducing deep sleep stages.

Another striking finding of the study is the discrepancy between sleep duration (quantity) and perceived sleep quality (quality). Although the average sleep duration was 7.0 hours, which is within physiological limits, 94.4% of the group rated their subjective sleep quality as "poor/very poor." This situation indicates that restorative sleep (REM and deep sleep) is disrupted by factors such as stress and blue light [30]. The fact that the most frequently reported disruption problem (35.8%) was "waking up in the middle of the night or too early in the morning" can also be explained by nomophobic tendencies and the subconscious urge to check notifications in this population [21]. As a reflection of this picture on daily life, it was determined that 47.6% of the participants experienced daytime dysfunction (difficulty staying awake) at least once a week. In the literature, excessive daytime sleepiness has been shown to have a strong relationship with the 'emotional exhaustion' dimension of professional burnout in medical students [35]. Therefore, this high rate is both a consequence of fragmented night sleep and an alarm symptom of academic burnout.

Despite the 94.4% rate of poor sleep quality, the fact that 95.1% of the students had not used sleep medication in the past month stands as a remarkable contrast. This finding fully aligns with the literature showing that medical students have a low tendency to seek medical help or use medication despite their sleep problems [36]. As emphasized by Azad et al., the intense cognitive effort and clinical responsibilities demanded by medical education lead students to perceive insomnia as an 'inevitable and natural cost' of the academic lifestyle. Instead of treating this condition pharmacologically, prospective physicians tend to normalize it [37].

When the relationship between nomophobia and sleep quality, which is the primary hypothesis of our study, was examined, no statistically significant correlation was found between the Total Nomophobia Score and the Total PSQI Score. In the multivariate logistic regression analysis, when factors such as gender, smoking status, and daily phone usage duration were controlled for, it was determined that nomophobia did not have an independent and decisive predictive effect on the deterioration of sleep quality ($p=0.376$). At first glance, this finding contrasts with national and international literature data reporting a direct positive correlation between nomophobia and PSQI scores in the general adult population and medical students [39,17]. However, when the sub-components of the PSQI are detailed, the effect of nomophobia on sleep is more clearly understood. In our study, a significant relationship was found between the "giving up convenience" sub-dimension of nomophobia and the total PSQI score. More importantly, all sub-dimensions of nomophobia showed a strong, positive, and significant relationship with the "Sleep Disturbances" (Component 5) sub-component of the PSQI, which questions the reasons for sleep fragmentation. Similarly, Sadeghi et al. reported that the level of nomophobia in medical students was particularly associated with the "sleep disturbances" and "daytime dysfunction" components [17]. This situation indicates that even if nomophobic anxiety does not directly shorten the total sleep duration (quantity) in medical students, it leads to sleep fragmentation (quality) characterized

by nocturnal awakenings and micro-arousals. Consequently, our findings suggest that the effect of nomophobia on sleep health is driven by more complex and indirect mechanisms based on mental arousal targeting sleep continuity, rather than a linear and total relationship.

There are several limitations that should be considered when interpreting the findings of this study. First, because the sample was limited to a single medical school, the generalizability of the findings to all medical students or the broader young adult population is restricted. Second, the reliance on self-report scales introduces potential information bias risks, such as social desirability bias or recall bias regarding digital screen time. Finally, the relatively limited explanatory power of the established regression model (Nagelkerke $R^2$ = 0.051) indicates that other environmental, academic workload, and neurobiological factors that may influence medical students' sleep quality and digital habits were not fully captured in this model.

Future research would benefit from longitudinal designs that objectively track smartphone usage through in-app logs or screen time data, and evaluate sleep parameters using physiological measurements such as actigraphy or polysomnography. Additionally, longitudinally examining the curriculum workload and the transitions between the preclinical and clinical phases of medical education would contribute significantly to understanding the dynamic trajectory of academic stress on nomophobia and sleep quality.

## Conclusion

In conclusion, this study demonstrates the adverse effects of nomophobia levels and digital habits on sleep quality among medical students. Despite the study's methodological limitations and the limited explanatory power of the established model, the findings clearly underscore the need for institutional interventions to support students' digital well-being and sleep health during intensive academic training periods. Future objective and longitudinal research will further elucidate the mechanisms underlying this dynamic interaction and guide the development of strategies aimed at preserving students' mental and physical health within medical education curricula.

## Declarations

# Consent to Participate:

Informed consent was obtained from all individual participants included in the study.

**Clinical trial number**

Not applicable.

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# Author Contribution

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by Ayşe KÜÇÜKBALLI. The first draft of the manuscript was written by Ayşe KÜÇÜKBALLI and Aynur ÖZDEMİR. All authors critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.


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# Data Availability

The datasets generated and/analyzed during the current study are not publicly available due to privacy and ethical restrictions imposed by the ethics committee. However, they are available from the corresponding author upon reasonable request and subject to necessary ethical approvals.

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# Figures

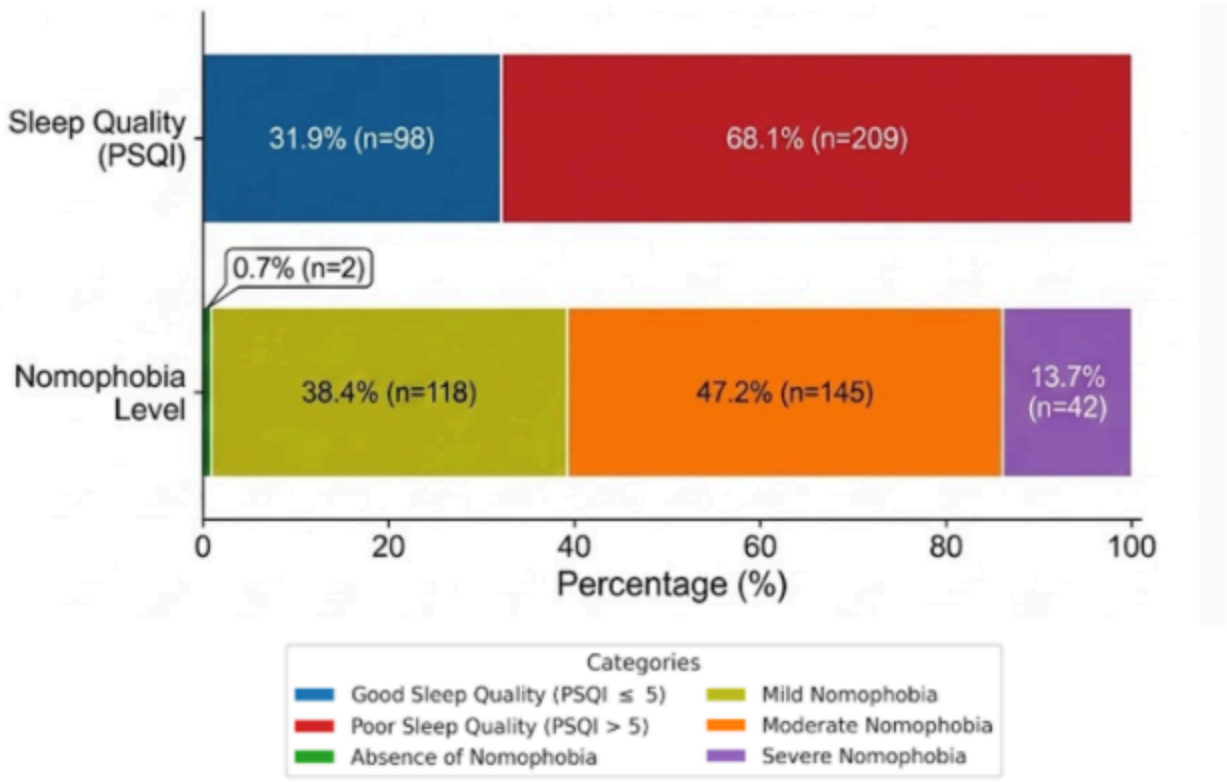



**Figure 1**

**Distribution of Sleep Quality and Nomophobia Levels**