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Effect of Smartphone Addiction on Sleep Quality Among Medical and Non-Medical Students

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ABSTRACT

Background: *Problematic smartphone use is increasingly recognized as a behavioral addiction in young adults and has been linked to sleep disruption, yet discipline-specific differences between medical and non-medical students remain underexplored.* ***Objective:*** *To compare smartphone addiction and sleep quality between medical and non-medical university students and to evaluate smartphone addiction as a predictor of sleep quality.* ***Methods:*** *A cross-sectional observational study was conducted from March to September 2025 across multiple universities in Sialkot, Pakistan, enrolling undergraduate students aged 18–25 years (N=378) with equal representation from medical and non-medical programs (n=189 each). Data were collected using a demographic questionnaire, the Smartphone Addiction Scale–Short Version (SAS-SV; range 10–60), and the Sleep Quality Scale (SQS; higher scores indicate poorer sleep). Group differences were assessed using Mann–Whitney U tests with effect sizes, and linear regression evaluated the association between SAS-SV and SQS.* ***Results:*** *Non-medical students reported significantly higher smartphone addiction than medical students (40.11±8.44 vs 28.08±8.65; p<0.001; r=0.58) and poorer sleep quality (32.82±11.74 vs 28.62±10.27; p<0.001; r=0.19). Smartphone addiction significantly predicted poorer sleep quality (B=0.26, 95% CI 0.16–0.36; β=0.26; R^2=0.067; F(1,376)=27.21; p<0.001).* ***Conclusion:*** *Higher smartphone addiction was associated with poorer sleep quality among university students, with non-medical students demonstrating a higher-risk profile. Targeted digital well-being and sleep-hygiene interventions may help reduce sleep disturbance in student populations.*

Keywords: *Smartphone addiction; Sleep quality; University students; Medical students; Non-medical students; SAS-SV; Sleep Quality Scale*

INTRODUCTION

Smartphones have rapidly evolved from basic communication devices into multifunctional tools that integrate social networking, entertainment, academic learning, and daily task management into a single portable platform. Their widespread adoption among young adults, particularly university students, has fundamentally altered patterns of communication, information access, and leisure activities (1). While these devices offer undeniable benefits, their excessive and uncontrolled use has raised growing concerns regarding behavioral dependency and its consequences for physical and mental health (2).

Problematic smartphone use, often conceptualized as smartphone addiction, is increasingly recognized as a form of behavioral addiction characterized by compulsive engagement, impaired control, tolerance, withdrawal-like symptoms, and functional impairment in daily life (3). Although smartphone addiction does not involve substance intake, neurobehavioral evidence suggests parallels with other non-substance addictions, including gambling and internet use disorders (4). Among students, excessive smartphone engagement has been consistently associated with heightened stress, anxiety, depressive symptoms, reduced academic productivity, and disturbances in sleep patterns (5).

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Sleep quality is a critical determinant of cognitive performance, emotional regulation, physical health, and academic success, particularly in young adults undergoing intensive educational demands (6). University students represent a vulnerable population due to irregular schedules, academic pressure, lifestyle changes, and increased nighttime technology use. Growing evidence indicates that excessive smartphone use, especially during evening and pre-sleep hours, adversely affects sleep quality through multiple mechanisms, including blue-light–induced suppression of melatonin secretion, psychological hyperarousal caused by constant notifications and social media engagement, and behavioral displacement of sleep time (7,8).

Numerous cross-sectional and longitudinal studies have demonstrated a significant association between smartphone addiction and poor sleep outcomes, including delayed sleep onset, reduced sleep duration, frequent nocturnal awakenings, and increased daytime sleepiness (9,10). Meta-analytic evidence further supports a moderate but consistent relationship between problematic smartphone use and sleep disturbance among student populations (11). These findings underscore smartphone addiction as an important behavioral risk factor for impaired sleep quality.

However, smartphone use behaviors and their health consequences may vary across academic disciplines due to differences in workload, stress exposure, time management, and health literacy. Medical students, for example, are exposed to rigorous curricula, prolonged study hours, and clinical responsibilities, which can independently compromise sleep quality while simultaneously necessitating frequent smartphone use for academic and clinical purposes (12). In contrast, non-medical students may engage more heavily in recreational smartphone activities such as social networking, gaming, and media consumption, which are strongly linked to addictive usage patterns and late-night screen exposure (13).

Despite the expanding body of literature on smartphone addiction and sleep quality, most studies have focused on single academic populations—predominantly medical students—or have examined students as a homogeneous group without stratification by discipline (14,15). Direct comparisons between medical and non-medical students within the same sociocultural and educational context remain limited, particularly in South Asian settings. This gap is important because differential academic environments and lifestyle patterns may influence both the intensity of smartphone addiction and its relationship with sleep outcomes.

Furthermore, while previous research has established associations between smartphone addiction and sleep disturbance, variability exists in reported prevalence rates and effect sizes, partly due to differences in measurement tools, sampling strategies, and cultural contexts (16). There is a need for methodologically rigorous studies using validated instruments to clarify whether smartphone addiction differentially affects sleep quality across academic disciplines and to quantify its predictive contribution to sleep disturbances.

Therefore, the present study was designed to address this knowledge gap by examining the association between smartphone addiction and sleep quality among university students in Sialkot, Pakistan, with a direct comparison between medical and non-medical students using standardized and psychometrically validated scales. By distinguishing these two student populations, the study aims to generate discipline-specific evidence that may inform targeted interventions and health promotion strategies within university settings.

MATERIAL AND METHODS

This cross-sectional observational study was conducted to examine the association between smartphone addiction and sleep quality among university students and to compare these outcomes between medical and non-medical academic disciplines. The study was carried out between March and September 2025 at multiple public and private universities located in Sialkot, Pakistan, representing a diverse range of academic environments and student populations. A cross-sectional design was selected as appropriate for estimating prevalence and assessing associations between behavioral exposures and health-related outcomes within a defined population at a single point in time (17).

Undergraduate students aged 18 to 25 years who were enrolled in either medical or non-medical academic programs were considered eligible for participation. Participants were required to be regular smartphone users, defined as individuals who reported using a smartphone for at least three hours per day, and to report an average nightly sleep duration of less than seven hours, indicating potential vulnerability to impaired sleep quality (18). Students with a prior clinical diagnosis of sleep disorders such as insomnia, sleep apnea, or narcolepsy, as well as those with known chronic medical conditions or psychiatric disorders that could independently affect sleep or smartphone use, were excluded to reduce confounding. Students not currently enrolled in a university program or unwilling to provide informed consent were also excluded.

Participants were selected using a purposive sampling approach to ensure equal representation of medical and non-medical students. Recruitment was conducted through in-person visits to academic departments and classrooms, where students were informed about the study objectives and procedures. Eligible students who expressed interest were invited to participate and provided written informed consent prior to enrollment. Participation was voluntary, and no financial or academic incentives were offered. To minimize selection bias, recruitment was conducted across different academic years and departments, and data collection sessions were scheduled at varying times.

Data were collected using a structured, self-administered questionnaire package completed in a supervised academic setting to ensure standardization. The questionnaire consisted of three components: a demographic data form, the Smartphone Addiction Scale–Short Version (SAS-SV), and the Sleep Quality Scale (SQS). Demographic variables included age, gender, academic discipline (medical or non-medical), and daily smartphone usage duration. Smartphone addiction was assessed using the SAS-SV, a validated 10-item instrument rated on a six-point Likert scale ranging from strongly disagree to strongly agree, with total scores ranging from 10 to 60, where higher scores indicate greater severity of problematic smartphone use (19). The SAS-SV has demonstrated strong construct validity and high internal consistency across multiple populations, including university students (20).

Sleep quality was assessed using the 28-item Sleep Quality Scale, which evaluates multiple dimensions of sleep including sleep initiation, sleep maintenance, daytime dysfunction, and subjective sleep satisfaction. Each item is rated on a Likert scale, and a total score is calculated, with higher total scores reflecting poorer sleep quality. The SQS has demonstrated excellent internal consistency and test–retest reliability and shows strong convergent validity with established sleep assessment tools such as the Pittsburgh Sleep Quality Index (21). All instruments were administered in English, which is the primary language of instruction at the participating universities.

To reduce information bias, standardized instructions were provided to all participants, and questionnaires were completed anonymously to encourage honest reporting. Data were

reviewed immediately after collection for completeness, and incomplete responses were excluded from analysis. Potential confounding variables such as age and gender were recorded and statistically controlled during analysis. Equal group sizes between medical and non-medical students were maintained to reduce imbalance-related bias in comparative analyses.

The sample size was determined to provide adequate power to detect a small-to-moderate association between smartphone addiction and sleep quality, based on effect sizes reported in previous studies examining similar outcomes in student populations (22). A total sample of 378 participants, with equal representation from medical and non-medical disciplines, was considered sufficient to ensure statistical precision for group comparisons and regression analyses.

Data were entered and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were computed for all variables. Normality of continuous variables was assessed using the Shapiro–Wilk and Kolmogorov–Smirnov tests. As the primary outcome variables deviated from normal distribution, non-parametric tests were used for inferential analysis. The Mann–Whitney U test was applied to compare smartphone addiction and sleep quality scores between medical and non-medical students. Effect sizes for group differences were calculated to assess the magnitude of associations. To examine the relationship between smartphone addiction and sleep quality, simple linear regression analysis was performed, with sleep quality as the dependent variable and smartphone addiction score as the independent variable. Missing data were handled using complete-case analysis, and statistical significance was set at $p < 0.05$.

Ethical approval for the study was obtained from the institutional ethics review committee of the University of Sialkot prior to data collection. All procedures were conducted in accordance with the Declaration of Helsinki. Participants were informed about the voluntary nature of the study, their right to withdraw at any time, and the confidentiality of their responses. No personally identifiable information was collected, and data were stored securely with access restricted to the research team to ensure data integrity and reproducibility.

RESULTS

A total of 378 undergraduate students were analyzed, with a mean age of 21.03 years (SD = 2.72; range 18–25). Females constituted the majority of the sample (262/378, 69.3%), while males accounted for 30.7% (116/378). The sample was intentionally balanced by academic discipline, with equal numbers of medical and non-medical students (189 each; 50.0% vs 50.0%). Overall, the mean smartphone addiction score (SAS-SV total) was 34.10 (SD = 10.45; range 10–58), and the mean sleep quality score (SQS total), where higher scores reflect poorer sleep quality, was 30.72 (SD = 11.21; range 0–69).

Group comparisons indicated statistically significant differences between medical and non-medical students for both sleep quality and smartphone addiction. For sleep quality, non-medical students showed higher mean ranks than medical students (210.04 vs 168.96), with a Mann–Whitney U of 13,979.0 and $Z = -3.66$ ($p < 0.001$). The corresponding effect size was small-to-moderate ($r = 0.19$), indicating that non-medical students tended to report poorer sleep quality. For smartphone addiction, the contrast between groups was much larger: non-medical students had substantially higher mean ranks (253.03) than medical students (125.97), with Mann–Whitney U = 5,853.0 and $Z = -11.31$ ($p < 0.001$). The effect size was large ($r = 0.58$), demonstrating a marked elevation of problematic smartphone use among non-medical students.

When expressed as group means for interpretability, medical students had a lower mean SQS score (28.62 ± 10.27) than non-medical students (32.82 ± 11.74). This corresponds to a mean difference of 4.20 points (non-medical minus medical), with a 95% confidence interval from 1.96 to 6.44 ($p < 0.001$), confirming that non-medical students reported significantly poorer sleep quality. The between-group difference in smartphone addiction was even more pronounced: medical students averaged 28.08 (SD = 8.65), whereas non-medical students averaged 40.11 (SD = 8.44), yielding a mean difference of 12.03 points with a 95% confidence interval from 10.38 to 13.67 ($p < 0.001$). Taken together, these estimates show that non-medical students were higher on both smartphone addiction and sleep disturbance, with the addiction gap being particularly large in magnitude.

Regression analysis further supported a significant linear association between smartphone addiction and sleep quality in the overall sample. Smartphone addiction (SAS-SV) significantly predicted poorer sleep quality (SQS), with an unstandardized slope B = 0.26 (SE = 0.05) and standardized $\beta = 0.26$ (95% CI for B: 0.16 to 0.36; $p < 0.001$). This indicates that for each 1-point increase in SAS-SV score, the SQS score increased by approximately 0.26 points, reflecting worsening sleep quality on average. The model was statistically significant ($F(1,376) = 27.21$; $p < 0.001$) and explained 6.7% of the variance in sleep quality ($R^2 = 0.067$; adjusted $R^2 = 0.065$), suggesting that while smartphone addiction is an important predictor, other unmeasured factors also contribute to sleep quality differences among students.

Table 1. Demographic and Descriptive Characteristics of Participants (N = 378)

Variable	N	Mean ± SD / n (%)	Minimum	Maximum
Age (years)	378	21.03 ± 2.72	18	25
Gender				
— Male	116	30.7%	–	–
— Female	262	69.3%	–	–
Academic discipline				
— Medical	189	50.0%	–	–
— Non-medical	189	50.0%	–	–
Smartphone Addiction Scale–SV (SAS-SV) total score	378	34.10 ± 10.45	10	58
Sleep Quality Scale (SQS) total score*	378	30.72 ± 11.21	0	69

Table 2. Comparison of Sleep Quality and Smartphone Addiction Scores Between Medical and Non-Medical Students (Mann–Whitney U Test)

Outcome	Group	N	Mean Rank	Mann–Whitney U	Z	p-value	Effect size (r)
Sleep Quality Scale (SQS)	**Medical**	189	168.96	13,979.0	−3.66	<0.001	0.19
	Non-medical	189	210.04				
Smartphone Addiction Scale (SAS-SV)	**Medical**	189	125.97	5,853.0	−11.31	<0.001	0.58
	Non-medical	189	253.03				

Table 3. Group-wise Means, Mean Differences, and 95% Confidence Intervals for Sleep Quality and Smartphone Addiction

Outcome	Group	Mean ± SD	Mean Difference (Non-medical − Medical)	95% CI	p-value
Sleep Quality Scale (SQS)	Medical	28.62 ± 10.27	4.20	1.96 to 6.44	<0.001
	Non-medical	32.82 ± 11.74			
Smartphone Addiction Scale (SAS-SV)	Medical	28.08 ± 8.65	12.03	10.38 to 13.67	<0.001
	Non-medical	40.11 ± 8.44			

Table 4. Linear Regression Analysis Predicting Sleep Quality from Smartphone Addiction (N = 378)

Predictor	B (Unstandardized)	SE	β (Standardized)	95% CI for B	t	p-value
Constant	21.66	2.04	–	17.65 to 25.67	10.61	<0.001
Smartphone Addiction (SAS-SV)	0.26	0.05	0.26	0.16 to 0.36	5.22	<0.001

The figure illustrates a clear and clinically meaningful gradient across academic disciplines, integrating group-level smartphone addiction severity and sleep quality outcomes. Non-medical students demonstrated markedly higher mean smartphone addiction scores (40.11 ± 0.61) than medical students (28.08 ± 0.63), reflecting a between-group difference of approximately 12 points on the SAS-SV. This substantial increase in problematic smartphone use was accompanied by a parallel worsening of sleep quality, with non-medical students showing higher mean SQS scores (32.82 ± 0.85) compared to medical students (28.62 ± 0.75), indicating poorer sleep.

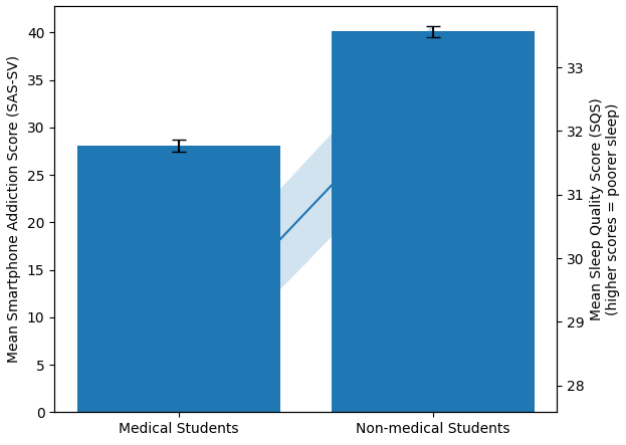

Figure 1 Gradient Relationship Between Smartphone Addiction and Sleep Quality Across Academic Disciplines

The aligned upward shift of both measures across groups highlights a graded association whereby greater smartphone addiction severity corresponds with poorer sleep quality at the population level. The narrow error margins suggest stable group estimates, reinforcing the robustness of the observed pattern. Clinically, this integrated visualization underscores that non-medical students occupy a higher-risk profile characterized by both elevated smartphone dependence and greater sleep disturbance, supporting the interpretation that

smartphone addiction may act as a meaningful behavioral contributor to impaired sleep in university populations.

DISCUSSION

This study examined the association between smartphone addiction and sleep quality among university students and compared these outcomes between medical and non-medical academic disciplines. The findings demonstrate that smartphone addiction is significantly associated with poorer sleep quality and that non-medical students exhibit substantially higher levels of smartphone addiction alongside greater sleep disturbance than their medical counterparts. These results contribute to the growing body of evidence identifying problematic smartphone use as an important behavioral correlate of impaired sleep in young adult populations (23).

The observed difference in smartphone addiction between academic disciplines was pronounced, with non-medical students scoring, on average, 12 points higher on the Smartphone Addiction Scale–Short Version than medical students. This large effect size aligns with previous research suggesting that non-academic and recreational smartphone use—such as prolonged engagement in social media, gaming, and streaming—is more strongly associated with addictive usage patterns than academically oriented use (24). Medical students, despite facing heavy academic demands, may engage with smartphones more purposefully for educational tasks and clinical coordination, which could partially mitigate the development of compulsive usage behaviors (25). Additionally, higher health literacy among medical students may promote greater awareness of the negative consequences of excessive nighttime smartphone use, leading to more adaptive self-regulation (26).

Sleep quality was also significantly poorer among non-medical students, as reflected by higher mean scores on the Sleep Quality Scale. Although the magnitude of this difference was smaller than that observed for smartphone addiction, it remained statistically meaningful. This finding is consistent with prior studies reporting that excessive smartphone use, particularly during evening hours, contributes to delayed sleep onset, fragmented sleep, and increased daytime dysfunction (27). The comparatively modest effect size suggests that sleep quality is influenced by multiple interacting factors beyond smartphone addiction alone, including academic workload, psychosocial stress, lifestyle habits, and circadian preferences (28).

Regression analysis further supported smartphone addiction as a significant predictor of sleep quality, explaining approximately 6.7% of the variance in sleep disturbance scores. While this proportion of explained variance is modest, it is consistent with previous studies examining behavioral determinants of sleep, where single behavioral exposures typically account for a limited but clinically relevant portion of outcome variability (29). The positive regression coefficient indicates that increasing levels of smartphone addiction are associated with incremental worsening of sleep quality, reinforcing the interpretation that problematic smartphone use functions as a meaningful risk marker for sleep disturbance rather than a trivial correlate.

The findings of this study are largely concordant with international literature. Systematic reviews and meta-analyses have reported moderate associations between smartphone addiction and poor sleep quality among students, with effect sizes comparable to those observed in the present study (30). Studies conducted in medical student populations alone have similarly documented high prevalence rates of smartphone addiction and sleep disturbance, although direct comparisons with non-medical students have been limited (31).

By incorporating both academic groups within the same sociocultural context, this study extends existing evidence and highlights that non-medical students may represent an equally, if not more, vulnerable group.

Several mechanisms may explain the observed association between smartphone addiction and sleep quality. Excessive smartphone use exposes individuals to blue light, which suppresses melatonin secretion and disrupts circadian rhythms, while constant connectivity and social media engagement increase cognitive and emotional arousal, delaying sleep initiation (32). Behavioral displacement, whereby smartphone use replaces time allocated for sleep, further exacerbates sleep deprivation (33). These mechanisms are likely amplified among individuals with addictive usage patterns, offering a plausible explanation for the graded relationship observed in this study.

Despite its strengths, including the use of validated instruments and balanced group representation, this study has limitations that should be acknowledged. The cross-sectional design precludes causal inference, and the directionality of the association cannot be established; it is possible that poor sleep quality also contributes to increased smartphone use. The reliance on self-reported measures introduces the potential for reporting bias. Additionally, the study did not assess other relevant confounders such as caffeine intake, mental health symptoms, academic stress, or bedtime-specific smartphone use, which may further influence sleep outcomes (34). Finally, purposive sampling from a single city may limit generalizability to other regions or educational contexts.

Nonetheless, the findings have important implications for student health promotion. Interventions aimed at improving sleep quality among university students should incorporate strategies to address problematic smartphone use, particularly among non-medical students who appear to be at higher risk. Educational programs emphasizing digital well-being, sleep hygiene, and mindful technology use may help mitigate sleep disturbances and improve overall well-being (35).

CONCLUSION

In conclusion, this study demonstrates a significant association between smartphone addiction and poorer sleep quality among university students, with non-medical students exhibiting markedly higher levels of smartphone addiction and greater sleep disturbance than medical students. Smartphone addiction emerged as a statistically significant predictor of sleep quality, underscoring its relevance as a behavioral risk factor for sleep-related problems in young adults. These findings highlight the need for targeted interventions promoting healthier smartphone use and improved sleep practices within university populations to support students' academic performance, mental health, and overall well-being.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of University of Sialkot, Sialkot, Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: AB, AQA; Design: AB, RR; Data Collection: HS, KZ, SS; Analysis: AQA, RR; Drafting: AB, HS, KZ, SS, RR

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