Original Research

Open Access

Belitung Nursing Journal
Volume 11(2), 133-141

https://doi.org/10.33546/bnj.3718

Smartphone addiction and sleep quality among nursing students in Meknes, Morocco: A cross-sectional study

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Abstract

Background: Smartphone addiction and poor sleep quality are prevalent health concerns that negatively impact students' physical and mental well-being, which could affect their academic performance. However, research on this subject in Morocco remains limited.
Objective: This study aimed to examine the impact of smartphone addiction on sleep quality and identify risk factors that moderate this relationship among nursing students.
Methods: This cross-sectional study was conducted from March to July 2023, involving 451 nursing students aged 17 to 23 at the Higher Institute of Nursing Professions and Health Techniques in Meknes, Morocco. Participants completed the Mobile Phone-Related Sleep Risk Factors Questionnaire (MRSRF), the Smartphone Addiction Scale–Short Version (SAS-SV), and the Pittsburgh Sleep Quality Index (PSQI). Binary logistic regression (BLR), Receiver Operating Characteristic (ROC) curves, and Area Under Curve (AUC) analyses were used to assess the impact of smartphone addiction on sleep quality and to identify moderating risk factors.
Results: The study found that 81.23% of nursing students experienced smartphone addiction, and 86.47% reported poor sleep quality. Sleep quality was significantly correlated with smartphone addiction (β = 0.174; p <0.001), use before bedtime (β = 1.018; p = 0.030), and duration of use after lights-off (β = 0.768; p = 0.047). Logistic regression analysis indicated that smartphone addiction (AUC = 0.872; p <0.001) and duration of use after lights-off (AUC = 0.668; p <0.001) were significant predictors of sleep quality.
Conclusion: This study found a significant correlation between smartphone addiction and poor sleep quality, as well as a negative impact of using smartphones in bed for more than 30 minutes after lights off. Nursing students with higher smartphone addiction levels, who use their devices for extended periods without blue light filters, are more likely to experience poor sleep quality. Addressing these challenges requires an integrated, multidisciplinary approach involving healthcare professionals, educators, and community stakeholders. Health promotion programs integrated into student curricula could help reduce smartphone addiction and encourage healthier sleep hygiene practices.

Keywords

Morocco; smartphone addiction; sleep quality; nursing students; ROC curve; area under curve; sleep quality; blue light; risk factors; logistic regression

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Article info:
Received: 5 November 2024
Revised: 9 December 2024
Accepted: 15 February 2025

E-ISSN: 2477-4073 | P-ISSN: 2528-181X

Background

Smartphones have become the most widely used means of communication today. According to the Digital Report, in 2024, the number of smartphone users worldwide has reached 5.68 billion (We Are Social, 2024) and is projected to rise to 7.8 billion by 2028 (Statista, 2023). This rapid proliferation has profoundly transformed daily life, providing unprecedented access to information, communication, and entertainment (Shanmugasundaram & Tamilarasu, 2023). Among young adults, particularly university students, smartphones have become integral to their routines (Alotaibi et al., 2022). However, uncontrolled smartphone use has raised concerns about its addictive potential (Weinstein & Siste, 2022), leading

to adverse effects on students' health and well-being (Larsen et al., 2023).

Sleep is essential for health and well-being, playing a crucial role in cognitive function, emotional regulation, and overall physical health (Ramar et al., 2021). One significant health concern associated with smartphone addiction is its impact on sleep quality. Sleep quality refers to the overall state of sleep in terms of depth, duration, regularity, and the sense of restfulness upon awakening. It is vital for mental and physical health, influencing brain activity, hormonal balance, and energy restoration (Stewart, 2024). A study by Bousgheiri et al. (2024) found that 81.7% of nursing students in Morocco suffer from poor sleep quality.

Smartphone addiction is characterized by excessive or uncontrolled dependence on smartphones, negatively affecting an individual's social, psychological, and physical well-being. Symptoms include compulsive use, stress when disconnected, and reduced daily performance (Akhtar et al., 2023; Ting & Chen, 2020). Benhammou et al. (2024) reported that 53% of the Faculty of Medicine and Pharmacy students in Fez were classified as smartphone addicts. Excessive smartphone use has been linked to sleep disorders, including delayed sleep onset, reduced sleep duration, poor sleep quality, and daytime sleepiness (Elsheikh et al., 2024).

Given the demanding nature of their studies and clinical placements, nursing students are particularly vulnerable to sleep disorders (Andargeery et al., 2024). Research indicates that nursing students frequently experience fragmented sleep, reduced sleep duration, and poor sleep quality (Belingheri et al., 2022). These sleep disturbances can negatively impact academic performance (Ibrahim et al., 2024), reduce concentration, and increase the likelihood of errors in patient care (Kwak et al., 2024).

Several studies have explored the relationship between smartphone addiction and sleep disorders among nursing students. Meneses and Andrade (2024) found that higher smartphone addiction scores were significantly associated with poor sleep quality, increased insomnia symptoms, and elevated levels of depression and anxiety. Similarly, Osorio-Molina et al. (2021) concluded that smartphone addiction significantly predicts sleep problems in nursing students. These findings underscore the need to address smartphone addiction as a key determinant of sleep quality, particularly in vulnerable populations like nursing students.

Despite the growing body of research examining the impact of smartphone addiction on sleep quality in university students (Abid et al., 2024; Correa-Iriarte et al., 2023; Goel et al., 2023; Höhn et al., 2024), significant gaps remain in our understanding of its effects. As of this study, few investigations have specifically examined the relationship between smartphone addiction and sleep quality among nursing students in Morocco. This research focuses on student nurses from the Higher Institute of Nursing Professions and Health Techniques in Meknes, a population facing intense academic and professional demands that may contribute to both smartphone addiction and sleep disorders.

The sleep quality of nursing students is crucial to their training and future practice, directly impacting their health, performance, and patient care. Additionally, their technological habits and lifestyles provide an opportunity to explore variables specific to Meknes and Morocco, informing culturally relevant awareness and prevention initiatives. Addressing this research gap is essential for developing policies that promote healthier smartphone usage and improved sleep hygiene among nursing students. Given the critical role of these students as future healthcare professionals, clarifying the impact of smartphone addiction on their sleep quality has profound implications for patient care effectiveness and the overall image of the Moroccan healthcare system. Considering these considerations, this study aims to investigate the impact of smartphone addiction and mobile-related sleep risk factors on the sleep quality of nursing students in Morocco.

Methods

Study Design

This study employed a quantitative cross-sectional research method. This approach was chosen to examine the relationship between smartphone addiction and sleep quality among nursing students.

Sample/Participants

Participants ranged in age from 17 to 23 years and were recruited through total sampling. Authorization to access the data was obtained from the management administration of the Higher Institute of Nursing Professions and Health Techniques in Meknes, Morocco. The inclusion criteria required participants to be actively enrolled students who owned a smartphone and consented to participate in the study.

Instruments

In addition to demographic variables such as age and gender, the study utilized three key instruments: the Smartphone Addiction Scale Short Version (SAS-SV), the Pittsburgh Sleep Quality Index (PSQI), and the Mobile Sleep Risk Factor Questionnaire (MRSRF).

The Smartphone Addiction Scale Short Version (SAS-SV) was developed by Kwon et al. (2013) to assess smartphone addiction. It consists of ten questions grouped into six dimensions: disruption of daily life, positive anticipation, withdrawal, cyberspace-oriented relationships, overuse, and tolerance. Responses were measured on a six-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). The total score was obtained by summing individual responses, with a threshold value of 31 indicative of addiction for males and 33 for females. The original SAS-SV demonstrated high internal consistency, with a Cronbach's alpha of 0.91 (Kwon et al., 2013), while the present study reported a Cronbach's alpha of 0.88, indicating good reliability.

The Pittsburgh Sleep Quality Index (PSQI), developed by Buysse et al. (1989), was used to measure subjective sleep quality over one month. It comprises nineteen self-reported questions and five additional questions assessed by a roommate or bed partner. The nineteen self-reported items are categorized into seven components: subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleeping pills, and daytime dysfunction. Each component is scored from 0 to 3, with total scores ranging from 0 to 21. Higher scores indicate poorer sleep quality. A cut-off score of 5 differentiates good sleep quality (PSQI < 5) from poor sleep quality (PSQI ≥ 5). The original PSQI demonstrated internal consistency with a Cronbach's

alpha of 0.83 (Buysse et al., 1989), while in the present study, the PSQI had a Cronbach's alpha of 0.70, indicating acceptable reliability.

The Mobile Sleep Risk Factor Questionnaire (MRSRF) was designed using Google Forms and validated by Rafique et al. (2020). This questionnaire assesses mobile-related sleep risk factors based on prior studies (Dimitriou et al., 2015; Haug et al., 2015; Sahin et al., 2013). It includes seven questions examining daily smartphone usage duration, smartphone use before bedtime, proximity of the smartphone while sleeping, activation of airplane mode before sleep, use of blue light filters, duration of smartphone use in bed after turning off the lights, and nighttime awakenings due to calls or notifications. The questionnaire's face validity was confirmed by experts in physiology and respiratory therapy. Reliability was tested using the test-retest method over a three-week interval with 30 students, yielding a high correlation coefficient (r = 0.84, p = 0.002).

Data Collection

Data were collected online between March and July 2023 using a census method to recruit all eligible students enrolled in the Higher Institute of Nursing Professions and Health Techniques in Meknes, Morocco. Participation was voluntary, and students provided consent before completing the survey.

Data Analysis

The Statistical Package for the Social Sciences (SPSS 25 for Windows) was used to perform the statistical analyses of the data. A descriptive analysis was conducted to summarize the demographic variables, mobile-related sleep risk factors, and model variables (SAV.SV and PSQI). Nominal variables are presented as frequencies and percentages, while continuous variables are presented as means and standard deviations. Logistic regression analysis was used to predict the impact of smartphone addiction (SA) and mobile-related sleep risk factors on the sleep quality (SQ) of nursing students.

The logistic regression equation is expressed as: $ln(Y/_{1-Y}) = \beta_0 + \beta_1 X_1 + \cdots + \beta_k X_k$ where $ln(Y/_{1-Y})$ describes the odds (probability) of experiencing poor sleep quality (sleep = 1), versus good sleep quality (sleep = 0). The β_k coefficients represent the respective effects of the predictor variables X_k. To interpret these coefficients, we calculate the Odds Ratios (OR) using the formula: $Cote_k\ (Odds\ ratio) = e^{\beta_k}$ The ROC (Receiver Operating Characteristic) curve was used to compare the performance of different classification models by calculating the area under the curve (AUC). This process allows us to evaluate the classification power of the variables retained in the final model. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

Informed consent was obtained from all participants, who were assured of the anonymity and confidentiality of their responses. Ethical approval for the study was granted by the Biomedical Research Ethics Committee (Comité d'Éthique pour la Recherche Biomédicale, CERB) of the Faculty of Medicine and Pharmacy, Mohammed V University, Rabat (Reference No. 62/23).

Results

Study Participants' Characteristics

A total of 493 paper questionnaires were distributed between March and April 2023. Of these, 42 were deemed incomplete, leaving 451 valid responses for analysis. Among the 451 participants, 68.7% (n = 310) were female, while 31.3% (n = 141) were male, resulting in an unequal gender distribution. The participants' ages ranged from 17 to 23 years, with an average age of 21.50 years (standard deviation [SD] = 0.71). The institute offers three study options, with the highest number of participants enrolled in the Multi-Disciplinary Nursing program, accounting for 49% (n = 221). This was followed by the Family and Community Health Nursing option at 23.1% (n = 104) and the Emergency and Intensive Care Nursing option at 21.1% (n = 95). The Midwifery option had the fewest participants, comprising only 6.9% (n = 31) of the study population. The training program at the institute spans three years. In terms of distribution by year of study, first-year students constituted the largest group, representing 42.6% (n = 192) of the sample. Second-year students accounted for 28.8% (n = 130), while third-year students made up 28.6% (n = 129) (**Table 1**).

Table 1 Descriptive statistics of study participants' characteristics

Variables	Category	*n*	%
Gender	Female	310	68.7
	Male	141	31.3
Year of Study	Year 1	192	42.6
	Year 2	130	28.8
	Year 3	129	28.6
Branch of Study	Family and Community Health Nursing	104	23.1
	Multi-Disciplinary Nursing	221	49.0
	Emergency and Intensive Care Nursing	95	21.1
	Midwifery	31	6.9

Table 2 presents the measures of central tendency (mean) and dispersion (standard deviation) for the Pittsburgh Sleep Quality Index (PSQI) and the Smartphone Addiction Scale Short Version (SAS-SV) scores, categorized by gender. The overall mean PSQI score for participants was 7.23 (± 2.34), which is greater than the threshold of 5, indicating that, on average, the study participants experienced poor sleep quality. Male participants had a slightly higher PSQI score of 7.48 (± 2.11) than female participants, who had a mean score of 7.12 (± 2.44). This suggests that, on average, male participants had worse sleep quality than female participants. Regarding smartphone addiction, the overall mean SAS-SV

score was 40.87 (± 8.46), exceeding the threshold of 33, which indicates that the students, on average, had signs of smartphone addiction. Males had a higher mean SAS-SV score of 42.91 (± 7.69) than females, with a mean score of 39.93 (± 8.65). This suggests that, on average, male participants were more addicted to their smartphones than female participants.

Table 2 Descriptive statistics for PSQI and SAS-SV scores by gender

Gender	PSQI (Mean ± SD)	SAS-SV (Mean ± SD)
Female	7.12 ± 2.44	39.93 ± 8.65
Male	7.48 ± 2.11	42.91 ± 7.69
Overall	7.23 ± 2.34	40.87 ± 8.46

Figure 1 and **Figure 2** show the individual PSQI and SAS-SV scores for female and male students, respectively. Both statistics reveal that, across all three curves, the majority of participants had scores exceeding the threshold for smartphone addiction (33 for females and 31 for males) and the threshold for poor sleep quality (5 for PSQI), regardless of gender. This indicates that most students, irrespective of gender, had signs of both smartphone addiction and poor sleep quality.

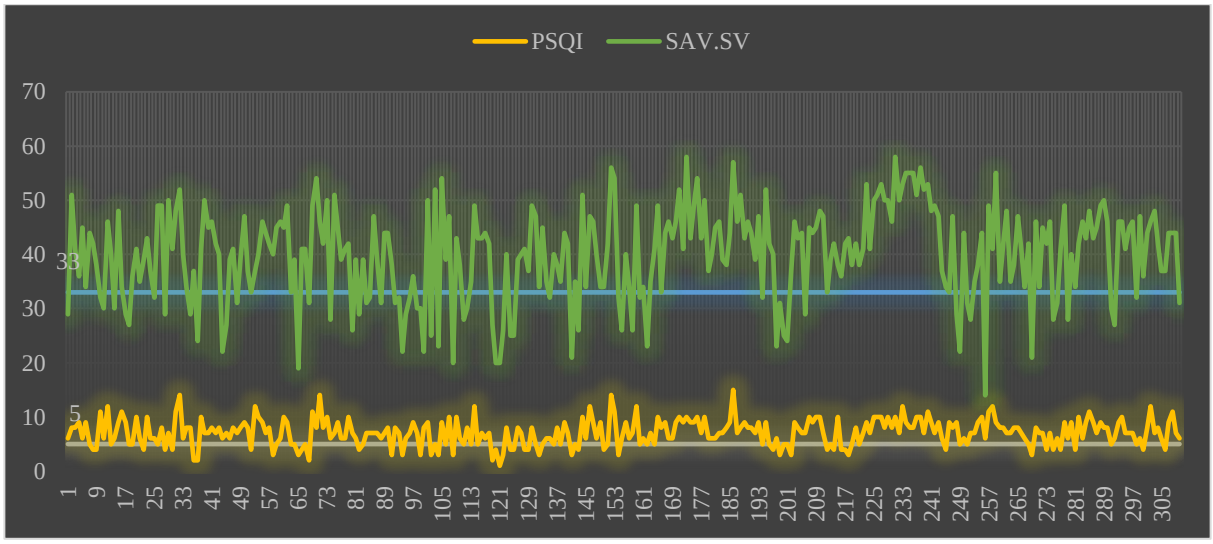

Figure 1 Diagram of PSQI and SAV.SV values for females

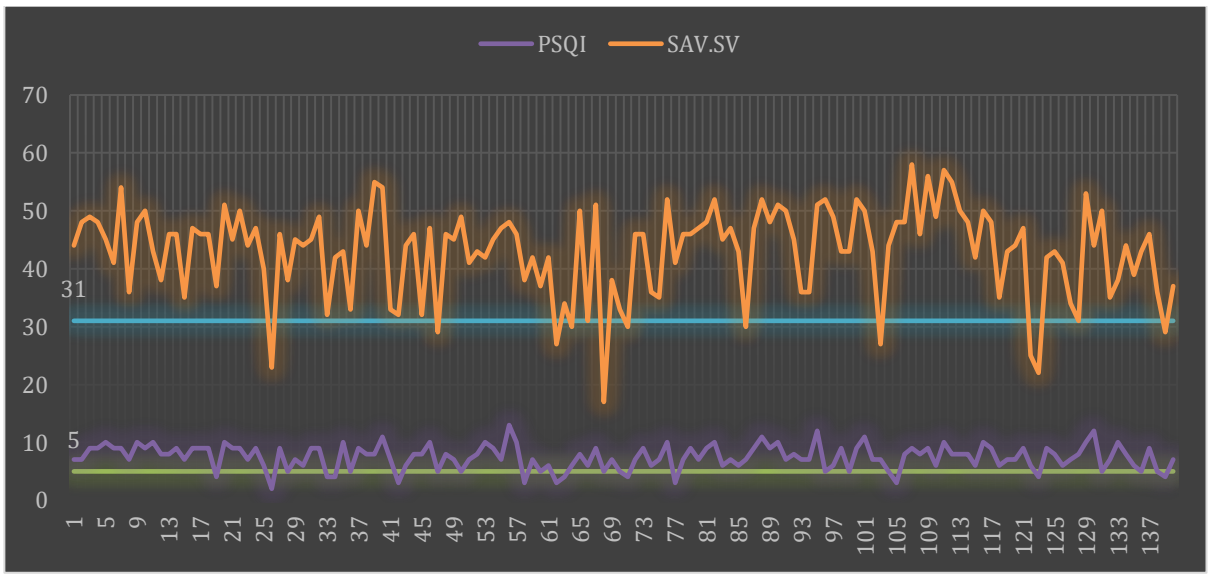

Figure 2 Diagram of PSQI and SAV.SV values for males

Table 3, which represents mobile-related sleep risk factors, shows that 40.1% of participants reported using their smartphones for more than 8 hours per day. Additionally, 94.7% of students did not use blue light filters on their smartphones. A significant majority (95.3%) placed their smartphones next to their beds before sleeping, and 91.6% used them before going to sleep. Furthermore, 83.8% of students reported using their smartphones for more than 30 minutes after turning off the lights.

Table 3 Percentages of responses to the Mobile Sleep Risk Factor Questionnaire (MRSRF)

Question	Item	No		Yes	
		n	%	*n*	%
1. Do you put your smartphone next to the bed before bed?	Risk factor 1	21	4.7	430	95.3
2. Do you use your smartphone before bed?	Risk factor 2	38	8.4	413	91.6
3. Do you put your smartphone on airplane mode before going to bed?	Risk factor 3	201	44.6	250	55.4
4. Do calls or notifications wake you up at night?	Risk factor 4	354	78.5	97	21.5
5. Do you use blue light filters on your cell phone?	Risk factor 5	427	94.7	24	5.3
6. How long do you use your smartphone after switching off the light? (Less than 30 minutes = 0; More than 30 minutes = 1)	Risk factor 6	73	16.2	378	83.8
7. How long do you estimate you use your phone per day? (Less than 8 hours = 0; More than 8 hours = 1)	Risk factor 7	270	59.9	181	40.1

The preliminary findings from **Table 2**, **Table 3**, **Figure 1**, and **Figure 2** suggest a pattern of smartphone addiction and behaviors that are likely to disrupt sleep quality. This indicates a potential positive correlation between the degree of smartphone dependence and sleep quality. To further investigate this relationship, the following steps were undertaken: 1) Assessment of the discriminative power of the model using the confusion matrix test. 2) Testing the significance of the predictors using the Odds Ratio. 3) Selection of the best classifier using the ROC curve and the AUC test.

Validation of the Binary Logistic Regression Model

Assessment of the Model's Discriminating Power

The confusion matrix in **Table 4** presents the logistic regression model's predictive power, including its sensitivity (percentage of true positives), specificity (percentage of true negatives), and overall predictive percentage. The results indicate that the model made incorrect predictions in 59 (13.1%) of the cases, while 373 (86.9%) of the predictions were accurate. This high percentage of correct predictions demonstrates the model's strong predictive capacity for the dependent variable.

Table 4 Evaluation of the discriminating power of the model using the confusion matrix test

Classification Table				
Observed		**Predicted**		
		Sleep		**Percentage Correct**
		0	**1**	
Sleep	0	9	52	14.8
	1	7	383	98.2
Overall percentage				86.9

Significance Testing of Predictors with the Odds Ratio

After modifying the model by removing atypical observations, the model's goodness of fit improved slightly, and it was deemed acceptable (as shown in **Table 4**). **Table 5** presents the results of the significance test for the model's predictors, following the model improvement. This test evaluates whether the predictors (smartphone addiction and MRSFR) significantly affect the probability of the dependent variable (sleep quality). The test calculates various beta coefficients and their corresponding exp(beta) values. The results indicate that for every unit increase in the SAS-SV score, the probability of poor sleep quality increases significantly (β = 0.174; *p* = 0.000***). Similarly, a one-unit increase in risk factor 2 results in a significantly higher probability of poor sleep quality (β = 1.018; *p* = 0.030**). In contrast, a one-unit increase in risk factor 5 leads to a significantly lower probability of poor sleep quality (β = -1.626; *p* = 0.058*). Additionally, a one-unit increase in Risk Factor 6 increases the probability of poor sleep quality significantly (β = 0.768; *p* = 0.047**) (**Table 5**).

Table 5 Significance test of the predictors used in the binary logistic regression model

Variable	*B*	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*	*95% C.I. for Exp(B)*
SAS_SV	0.174	0.026	45.926	1	0.000***	1.190	1.132 - 1.252
Risk Factor 2	1.018	0.470	4.693	1	0.030**	2.768	1.102 - 6.955
Risk Factor 5	-1.626	0.857	3.600	1	0.058*	0.197	0.037 - 1.055
Risk Factor 6	0.768	0.387	3.946	1	0.047**	2.156	1.010 - 4.600
Constant	-4.135	1.068	14.989	1	0.000**	0.016	

Note: (***): Significant at the 1% | (**): Significant at the 5% | (*): Significant at the 10%

Based on the model selected, the equation predicting the probability of poor sleep quality is expressed as follows:

$$ln\left({}^{Y}/_{1\_Y}\right) = -4.135 + 0.174 \times SAV.SV - 1.626 \times Risk\ Factor\ 2 + 1.018 \times Risk\ Factor\ 5 + 0.768 \times Risk\ Factor\ 6 \quad (1)$$

$$Y = \frac{e^{-4.135 + 0.174 \times SAV.SV - 1.626 \times Risk\ Factor\ 2 + 1.018 \times Risk\ Factor\ 5 + 0.768 \times Risk\ Factor\ 6}}{1 + e^{-4.135 + 0.174 \times SAV.SV - 1.626 \times Risk\ Factor\ 2 + 1.018 \times Risk\ Factor\ 5 + 0.768 \times Risk\ Factor\ 6}} \quad (2)$$

Choosing the Best Classifier Using the ROC Curve

Figure 3 displays the results of the ROC curve, which evaluates the prediction performance of the binary logistic regression classification model. This curve helps identify the optimal point that maximizes both sensitivity and specificity, allowing us to determine the predictor variable that offers the best probability of a success event (in this case, poor sleep quality). The SAS_SV score provides the best predictor for sleep quality, with its ROC curve (purple) positioned far from the diagonal line (red), which represents a random classifier (50%; 50%). Following SAS_SV, risk factor 6 (orange), which represents the duration of smartphone use after switching off the light, is the second-best predictor. Risk factor 5 (green) performs poorly as a classifier, being close to the diagonal, while risk factor 2 (blue) is almost indistinguishable from the diagonal, indicating its similarity to a random classifier.

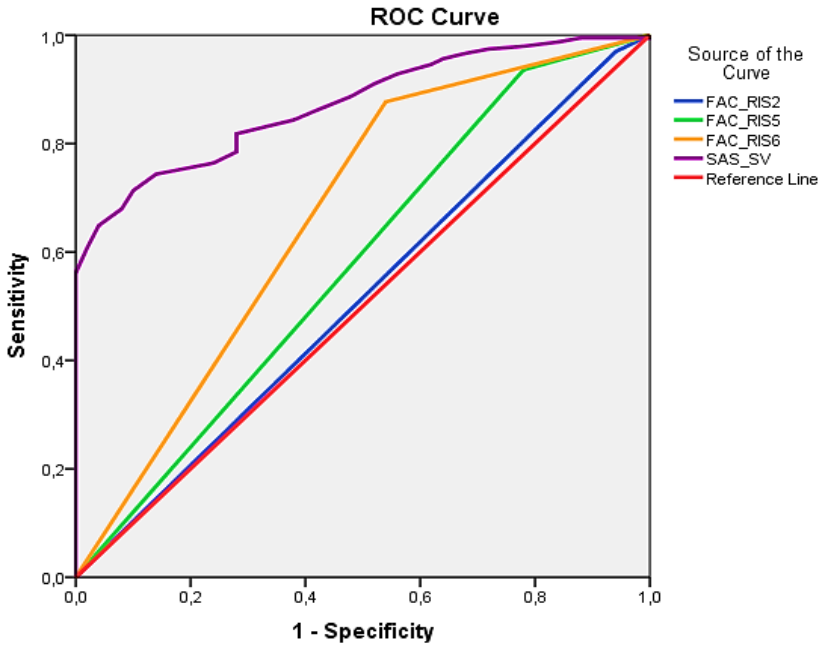

Figure 3 Sensitivity and specificity curves for selected predictors - ROC curves

Area Under the Curve (AUC)

Table 6 presents the results of the Area Under the Curve (AUC) test. The findings suggest that only the SAS_SV factor and Risk Factor 6 (duration of smartphone use after switching off the light) classify students based on sleep quality better than a random classifier. The AUC for SAS_SV is 0.872, and for Risk Factor 6, it is 0.668, with p <0.001, indicating statistical significance. Thus, the SAS_SV variable allows for a 0.872 probability of determining whether a student has poor sleep quality, while the presence of information on Risk Factor 6 offers a 0.668 probability.

Table 6 Area Under the Curve (AUC) test for model predictors

Test Result Variable(s)	Area	Std. Error	Asymptotic Sig.	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
Risk Factor 2	0.578	0.047	0.073	0.487	0.669
Risk Factor 5	0.515	0.044	0.736	0.428	0.601
Risk Factor 6	0.668	0.046	0.000	0.579	0.758
SAS_SV	0.872	0.020	0.000	0.833	0.910

These results support the hypothesis confirmed by the logistic model, demonstrating that smartphone addiction significantly impacts sleep quality. Additionally, the duration of smartphone use in bed after switching off the light also affects sleep quality.

Discussion

Summary of the Findings

The present study aimed to examine the impact of smartphone addiction and mobile-related sleep risk factors on sleep quality among nursing students. The results of binary logistic regression indicated that sleep quality was significantly correlated with smartphone addiction, as well as the second, fifth, and sixth risk factors. However, based on the receiver operating characteristic curve and area under the curve results, only smartphone addiction and the sixth risk factor were found to have a significant impact and were able to predict sleep quality accurately. Specifically, students with smartphone addiction who used their phones before bed for over 30 minutes, without a blue light filter, after the lights were off were more likely to experience poor sleep quality.

The prevalence of smartphone addiction among nursing students in this study was 81.23%, aligning with figures from countries with similar cultural backgrounds, such as 66.9% in Saudi Arabia (Larsen et al., 2023), 87.8% in Egypt (Khalifa et al., 2023), and 80.15% in Turkey (Karaduman et al., 2024). In Morocco, 51.2% of students in the Settat region reported smartphone addiction (Moustakbal & Maataoui, 2022). These

variations may be attributed to differences in socio-cultural contexts, access to devices, and measurement scales. Similarly, studies from various countries, including Ethiopia (41.6%) (Esubalew et al., 2024), UAE (56.2%) (Hasan et al., 2023), and China (71.9%) (Zhang & Wu, 2020), show varying rates of smartphone addiction, often with high levels of poor sleep quality, as seen in our study where 86.47% of nursing students reported poor sleep quality. These findings suggest a global trend linking smartphone addiction to poor sleep quality.

This study is one of the few to examine smartphone addiction's impact on sleep quality while considering mobile-related sleep risk factors. Regarding the impact of smartphone addiction on sleep quality, this study found a significant association between higher levels of smartphone addiction and poor sleep quality. This finding aligns with previous studies that also report an adverse effect of smartphone addiction on sleep quality, suggesting that students with a higher tendency toward smartphone addiction tend to experience worse (Alahdal et al., 2023; Kalal et al., 2023; Zhu et al., 2024). Given that nursing students often face high academic and clinical stress (Labrague, 2024), smartphone use is frequently employed as a coping mechanism (Tu et al., 2023)), which may lead to addictive behaviors linked to smartphone use (Zhang et al., 2022).

A key finding of this study is the association between smartphone use for more than 30 minutes after lights out and poor sleep quality. These results are consistent with previous research (Rafique et al., 2020), which indicated that smartphone use for at least 30 minutes before bed is linked to poor sleep quality, daytime sleepiness, and increased sleep latency. Similarly, Meng et al. (2021) found that smartphone use for over 30 minutes before bed significantly increased the risk of poor sleep quality, though they did not specify whether a blue light filter was used.

The blue light emitted by smartphone screens is known to disrupt the circadian rhythm by delaying melatonin release, which can lead to sleep disturbances and poor sleep quality (Didikoglu et al., 2023; Höhn et al., 2021). Previous studies suggest that using a blue light filter on smartphones can mitigate these effects and improve sleep quality (Rabiei et al., 2024; Wu et al., 2024). These findings emphasize the importance of both the timing and the conditions under which smartphones are used, particularly before bedtime.

Overall, this study highlights the significant role of smartphone addiction and mobile-related sleep risk factors in predicting poor sleep quality among nursing students. Addressing these factors, such as limiting smartphone use before bedtime and using blue light filters, could improve sleep quality in this population.

Strengths and Limitations

One of the main strengths of this study is the relatively large sample size (*N* = 451), as it included all students from the Higher Institute of Nursing Professions and Health Techniques of Meknes, Morocco, using a census approach. Additionally, this study is one of the few to examine the impact of smartphone addiction on sleep quality while considering mobile-related sleep risk factors. It highlights the adverse effects of smartphone addiction on sleep quality, particularly concerning nighttime smartphone use after lights out and the lack of blue light filters—critical yet often overlooked aspects of smartphone use among nursing students.

However, certain limitations should be acknowledged. First, the study results suggest a significant association between smartphone addiction and poor sleep quality, but the cross-sectional design cannot infer causality. Second, the study's sampling method, though comprehensive within the selected institution, was limited to a single institution, which restricts the generalizability of the findings to the broader population of nursing students in Morocco. Furthermore, the study did not account for potential confounding factors such as academic stress, caffeine consumption, mental health disorders, or lifestyle habits, which may influence sleep quality. Finally, the study relied on self-reported measures of smartphone addiction and sleep quality. While these instruments are validated and reliable, they are inherently subjective and may introduce response bias.

Implications of the Study

The findings of this study reveal that nursing students in Morocco face two major challenges: smartphone addiction and poor sleep quality. Considering Morocco's unique cultural and academic context, these results provide valuable insights for policymakers to design interventions that address students' academic and health well-being. To mitigate the harmful effects of smartphone addiction and improve students' sleep quality, several interventions could be implemented. Awareness campaigns should be launched to emphasize the negative health consequences of excessive smartphone use, and workshops on sleep hygiene can help students develop healthier sleep habits. Providing psychological counseling and group support services can also address emotional and mental health needs. Additionally, promoting Moroccan cultural and social values that prioritize family life and community engagement could help students limit their smartphone use in social interactions.

For future research, longitudinal or experimental studies are essential to confirm causal relationships between smartphone addiction, sleep quality, and academic performance. Expanding the sample to include several institutions and employing random sampling techniques would improve the generalizability of the results. Moreover, incorporating objective measures to assess sleep quality, such as actigraphy or polysomnography, would strengthen the validity of the findings. It is also important to consider potential confounding factors—such as academic stress, caffeine consumption, mental health disorders, and lifestyle habits—when assessing sleep quality in order to improve the scientific rigor and accuracy of future studies.

Conclusion

Smartphone addiction and poor sleep quality have become prevalent health concerns, particularly among young adults and university students. These issues can negatively affect both the physical and mental well-being of students, ultimately impacting their academic performance. Our study found a significant positive correlation between smartphone addiction and poor sleep quality, as well as a significant negative impact of using smartphones in bed for more than 30 minutes after lights off. This suggests that students with higher levels of

smartphone addiction who use their devices for extended periods in bed without blue light filters are more likely to experience poor sleep quality. In light of these findings, the study highlights the need for an integrated, multidisciplinary approach to address these challenges. Involving healthcare professionals, educators, and community stakeholders is crucial. Furthermore, integrating health promotion programs into the student curriculum could serve as an effective preventive strategy to reduce smartphone addiction and encourage the adoption of healthy sleep hygiene practices among students.

Declaration of Conflicting Interest

There is no conflict of interest to declare.

Funding

None.

Acknowledgment

The authors thanked the Higher Institute of Nursing Professions and Health Techniques staff in Meknes, Morocco, for their contribution to this study's success.

Authors' Contributions

AE: Writing – original draft, conceptualization, data analysis, review and editing, YM: Writing – original draft, review and editing, MB: Writing – original draft, Visualization, Review and editing, AM: Review and editing, HB: review and editing, HI: Review and editing, FE: Review, and editing.

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Data Availability

The dataset generated during and analyzed during the current study is available from the corresponding author upon reasonable request.

Declaration of Use of AI in Scientific Writing

There is nothing to declare.

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Cite this article as: Haddaouy, A. E., Miyah, Y., Benjelloun, M., Mengad, A., Blaak, H. Iziki, H., & Omari, F. E. (2025). Smartphone addiction and sleep quality among nursing students in Meknes, Morocco: A cross-sectional study. *Belitung Nursing Journal, 11*(2), 133-141. https://doi.org/10.33546/bnj.3718