



Original Research Article

ASSOCIATION OF PROBLEMATIC SMARTPHONE USE AND SLEEP QUALITY WITH DEPRESSION AND ANXIETY AMONG YOUNG ADULTS: A CROSS-SECTIONAL STUDY

Tanuj Verma¹, Jaun Zeb Rizvi², Fazeelah Tasleem³, Nadeem Ahmad⁴, Rubeena Bano⁵

¹Associate Professor, Department of Psychiatry, United Institute of Medical Sciences, Prayagraj, India.

²Associate Professor, Department of Community Medicine, Autonomous State Medical College, Lakhimpur Kheri, India.

³Assistant Professor, Department of Community Medicine, Sardar Patel Institute of Medical Education and Health Sciences, Lucknow, India.

⁴Associate Professor, Department of Family and Community Medicine and Medical Education, College of Medicine, Taibah University, Madinah, Kingdom of Saudi Arabia.

⁵Associate Professor, Department of Physiology, College of Medicine, Taibah University, Madinah, Kingdom of Saudi Arabia.

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Corresponding Author:

Dr. Jaun Zeb Rizvi,
Associate Professor, Department of
Community Medicine, Autonomous
State Medical College, Lakhimpur
Kheri, India.
Email: jaunzeb1988@gmail.com

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ABSTRACT

Background: Problematic smartphone use (PSU) and sleep disturbance are increasingly recognized as potentially important correlates of psychological distress in young adults. **Objective:** To determine the prevalence and severity of PSU, poor sleep quality, depression, and anxiety, and to assess the associations of PSU and sleep quality with depression and anxiety among young adults.

Materials and Methods: A hospital-based analytical cross-sectional study included 205 young adults aged 18-25 years. PSU was classified using the prespecified study score threshold, sleep quality was assessed with the Pittsburgh Sleep Quality Index, and depression and anxiety were assessed using the DASS-21. Bivariate associations were tested using Pearson chi-square tests. Separate multivariable binary logistic regression models estimated adjusted odds ratios (AORs) with 95% confidence intervals (CIs), controlling for age, sex, physical activity, caffeine intake, bedtime smartphone use, and night-time notifications.

Results: PSU was present in 75.6% of participants, poor sleep quality in 69.3%, depression in 53.7%, and anxiety in 66.8%. Depression was more frequent among participants with PSU than among non-problematic users (62.6% vs 26.0%; $p < 0.001$), as was anxiety (75.5% vs 40.0%; $p < 0.001$). After adjustment, PSU remained associated with depression (AOR 5.41, 95% CI 2.09-14.03; $p < 0.001$) and anxiety (AOR 3.25, 95% CI 1.32-8.00; $p = 0.010$). Poor sleep quality showed the strongest independent associations with depression (AOR 9.66, 95% CI 4.05-23.07; $p < 0.001$) and anxiety (AOR 8.91, 95% CI 3.94-20.18; $p < 0.001$).

Conclusion: PSU and poor sleep quality were highly prevalent and independently associated with depression and anxiety. The findings support integrated assessment of digital-use patterns, sleep health, and psychological symptoms in young adults, while the cross-sectional design precludes causal inference.

Keywords: problematic smartphone use; sleep quality; depression; anxiety; young adults; digital health.

INTRODUCTION

Smartphones have become an integral component of everyday life, providing convenient access to communication, education, entertainment, social networking, and health-related information. However, increasing dependence on smartphones has raised concerns regarding problematic smartphone use (PSU) and its potential consequences for physical and psychological well-being. A systematic review of adult populations reported that smartphone addiction is associated with several adverse health outcomes, highlighting excessive smartphone use as an emerging public health concern rather than merely a behavioral or technological issue.^[1]

Sleep represents one of the most important domains potentially affected by smartphone use. Smartphone engagement, particularly during the period immediately preceding or during intended sleep, may interfere with normal sleep patterns. Research among Chinese college students examining daytime physical activity, while-in-bed smartphone use, sleep delay, and sleep quality demonstrated the interconnected nature of smartphone-related behaviors and sleep outcomes.^[2] These findings are particularly relevant to young adults and students, who frequently use smartphones for both academic and recreational purposes and may therefore be exposed to prolonged or late-night smartphone use.

The potential consequences of excessive smartphone use extend beyond sleep. In a study of Australian adults, excessive smartphone use was associated with depression, anxiety, stress, and sleep quality, suggesting that problematic smartphone behavior may coexist with multiple dimensions of psychological distress.^[3] The relationship between smartphone addiction and mental health is also of particular importance among medical students, a population exposed to substantial academic demands and potentially irregular lifestyles. Nikolic et al. reported an association between smartphone addiction, sleep quality, depression, anxiety, and stress among medical students, emphasizing the need to consider smartphone behaviour alongside both sleep and psychological well-being in this population.^[4]

The problem may begin even earlier in the educational trajectory. Among high school students in Mexico City, problematic use of smartphones and social media was examined in relation to sleep quality, indicating that sleep-related consequences of digital-device use are relevant even among younger populations.^[5] Furthermore, smartphone use cannot be considered independently of other lifestyle behaviors. A cross-sectional study investigating nighttime exercise, problematic smartphone use before sleep, and associated health issues further emphasized the complex relationship between behavioral patterns occurring during the evening and smartphone-related outcomes.^[6]

University students may be particularly vulnerable because smartphones are deeply embedded in their academic, social, and personal routines. Research examining smartphone addiction among university students has additionally linked it with attention-deficit/hyperactivity symptoms and sleep quality, suggesting that the consequences of problematic use may encompass cognitive as well as sleep-related domains.^[7] In the Indian context, research among adolescents aged 15–19 years in Gujarat has examined smartphone addiction in relation to parenting styles and mental well-being, demonstrating the importance of considering psychosocial factors when studying problematic smartphone behaviour.^[8]

Medical students constitute another important population for investigation because of their intensive academic schedules, high dependence on digital resources, and potentially disrupted sleep routines. Recent evidence from Sudan has specifically examined the impact of smartphone addiction on health status, mental well-being, and sleep quality among medical students, further supporting the relevance of simultaneously evaluating smartphone use, sleep, and psychological outcomes.^[9]

Despite increasing evidence linking problematic smartphone use with sleep and mental health, these relationships may vary according to population, behavioral patterns, and contextual factors. There is therefore a need for further observational research using standardized measures to quantify problematic smartphone use and systematically evaluate its relationship with sleep quality and psychological well-being. The present study aims to investigate the association of problematic smartphone use with sleep quality, depression, anxiety, and stress among young adults, thereby contributing to the growing evidence regarding the broader public health implications of excessive smartphone use.

Objectives

1. To determine the prevalence and severity of problematic smartphone use, poor sleep quality, depression, and anxiety among young adults during the study period.
2. To assess the association between problematic smartphone use and sleep quality with depression and anxiety among young adults.

MATERIALS AND METHODS

Study design and setting

A hospital-based analytical cross-sectional study was conducted at the United Institute of Medical Sciences, Prayagraj, among young adults aged 18–25 years during the predefined study period. The study examined problematic smartphone use (PSU) and sleep quality as the principal exposure variables and depression and anxiety as the primary psychological outcomes.

Study population and analytical eligibility

Young adults aged 18-25 years who provided written informed consent and completed the study questionnaire were eligible for the analytical dataset. For the present analysis, a record was required to contain complete information for PSU status, Pittsburgh Sleep Quality Index (PSQI), DASS-21 depression and anxiety scores, and the prespecified covariates. The finalized dataset contained 205 complete participant records; therefore, no record was excluded for missing principal variables and no imputation was required.

Sample size

The sample size was estimated using the single-proportion formula $n = Z^2 P(1-P)/d^2$, following the approach cited from Amin et al.^[9] Further, using an expected proportion of 75%, a 90% confidence level ($Z = 1.645$), and 5% absolute precision, the minimum required sample was approximately 203 participants. The final target was set at 205, and all 205 complete records were included in the analysis.

Study variables and assessment instruments

The primary outcomes were depression and anxiety. The main explanatory variables were PSU and poor sleep quality. Age, sex, physical activity, caffeine intake, bedtime smartphone use, and night-time notification exposure were treated as potential demographic or lifestyle covariates. Residence, current educational/occupational status, weekend sleep shift, and daily smartphone-use duration were summarized descriptively.

Problematic smartphone use: PSU was quantified using the standardized PSU score recorded in the study protocol and dataset. Scores ranged from 8 to 60 in the analyzed data. The prespecified binary classification defined a score of 31 or higher as problematic use and a score of 30 or lower as non-problematic use.

Sleep quality: Sleep was assessed using the Pittsburgh Sleep Quality Index (PSQI; score range 0-21). A global PSQI score of 0-5 was classified as good sleep quality and a score of 6 or higher as poor sleep quality.

Depression and anxiety: Symptoms were assessed using the Depression Anxiety Stress Scales-21 (DASS-21) and interpreted on the 0-42 subscale metric used in the dataset. Depression was categorized as normal (0-9), mild (10-13), moderate (14-20), severe (21-27), or extremely severe (28 or

higher); a score of 10 or higher defined a depression case. Anxiety was categorized as normal (0-7), mild (8-9), moderate (10-14), severe (15-19), or extremely severe (20 or higher); a score of 8 or higher defined an anxiety case.

Data collection procedure

After written informed consent, participants completed a structured questionnaire covering sociodemographic characteristics, lifestyle factors, smartphone-use behavior, the PSU score, PSQI items, and DASS-21 items. Data were coded using predefined categories and checked for completeness and internal consistency before analysis. Participant identifiers were retained only as study codes in the analytical file.

Statistical Analysis

Statistical analysis was performed in Python 3.13.5 using SciPy 1.17.0 and statsmodels 0.14.6. Continuous variables were summarized using mean and standard deviation (SD), with range where informative, and categorical variables were summarized as frequency and percentage. The prevalence and severity distributions of PSU, poor sleep quality, depression, and anxiety were calculated using the full analyzed sample ($n = 205$). Bivariate associations between PSU status or sleep quality and the binary depression and anxiety outcomes were tested using Pearson chi-square tests. Separate multivariable binary logistic regression models were fitted for depression and anxiety. Each model included PSU status and sleep quality as the principal predictors and was adjusted for age, sex, physical activity (per 60 minutes/week), caffeine intake (cups/day), bedtime smartphone use (<30 minutes as the reference category), and night-time notifications. Adjusted odds ratios (AORs), 95% confidence intervals (CIs), and two-sided p values were reported. Model performance was additionally summarized using McFadden pseudo-R² and area under the receiver operating characteristic curve (AUC). Statistical significance was set at $p < 0.05$.

Ethical considerations

The study protocol was subject to institutional ethical oversight before participant enrollment. Written informed consent was obtained from participants, and confidentiality was maintained through coded records and restricted use of study data.

RESULTS

Table 1: Sociodemographic, smartphone-use, and lifestyle characteristics of participants (n = 205)

Characteristic	Category / statistic	Value
Age (years)	Mean $\pm$ SD (range)	21.76 $\pm$ 2.13 (18-25)
Sex	Female	107 (52.2%)
	Male	98 (47.8%)
Residence	Urban	90 (43.9%)
	Semi-urban	53 (25.9%)
	Rural	62 (30.2%)
Current status	Undergraduate student	114 (55.6%)
	Postgraduate student	23 (11.2%)
	Intern/trainee	39 (19.0%)
	Employed	24 (11.7%)

	Other	5 (2.4%)
Physical activity (min/week)	Mean $\pm$ SD	159.92 $\pm$ 81.93
Caffeine intake (cups/day)	Mean $\pm$ SD	1.65 $\pm$ 1.08
Bedtime smartphone use	<30 min	26 (12.7%)
	30-60 min	63 (30.7%)
	61-120 min	67 (32.7%)
	>120 min	49 (23.9%)
Night-time notifications	Yes	89 (43.4%)
	No	116 (56.6%)
Weekend sleep shift (hours)	Mean $\pm$ SD	1.74 $\pm$ 0.88
Daily smartphone use (hours)	Mean $\pm$ SD	6.13 $\pm$ 1.73

All 205 participants had complete data for the principal variables. The mean age was 21.76 $\pm$ 2.13 years, with females accounting for 52.2% of the sample. Urban residents constituted 43.9%, and 55.6% were undergraduate students. Mean daily smartphone use was 6.13 $\pm$ 1.73 hours. More than

half of participants (56.6%) reported at least 61 minutes of smartphone use at bedtime, and 43.4% reported receiving night-time notifications. Mean physical activity was 159.92 $\pm$ 81.93 minutes/week and mean caffeine intake was 1.65 $\pm$ 1.08 cups/day.

Table 2: Prevalence and severity of problematic smartphone use, poor sleep quality, depression, and anxiety (n = 205)

Study measure	Category	n	%
Problematic smartphone use	Non-problematic	50	24.4
	Problematic	155	75.6
Sleep quality (PSQI)	Good	63	30.7
	Poor	142	69.3
Depression (DASS-21)	Normal	95	46.3
	Mild	52	25.4
	Moderate	50	24.4
	Severe	8	3.9
	Extremely severe	0	0.0
	Depression case (score $\geq$ 10)	110	53.7
Anxiety (DASS-21)	Normal	68	33.2
	Mild	22	10.7
	Moderate	85	41.5
	Severe	24	11.7
	Extremely severe	6	2.9
	Anxiety case (score $\geq$ 8)	137	66.8

Problematic smartphone use was identified in 155 participants (75.6%), while poor sleep quality was present in 142 (69.3%). Depression at or above the case threshold was observed in 110 participants (53.7%). Mild depression was present in 25.4%, moderate depression in 24.4%, and severe depression in 3.9%; no participant fell in the

extremely severe depression category. Anxiety at or above the case threshold was observed in 137 participants (66.8%). Moderate anxiety was the most frequent symptomatic category (41.5%), followed by severe (11.7%), mild (10.7%), and extremely severe anxiety (2.9%).

Table 3: Association of problematic smartphone use with depression and anxiety

Outcome	PSU category	Outcome absent n (%)	Outcome present n (%)	Chi-square	p value
Depression	Non-problematic	37 (74.0%)	13 (26.0%)	18.90	<0.001
	Problematic	58 (37.4%)	97 (62.6%)		
Anxiety	Non-problematic	30 (60.0%)	20 (40.0%)	19.90	<0.001
	Problematic	38 (24.5%)	117 (75.5%)		

Depression was substantially more frequent among participants with PSU than among those without PSU (62.6% vs 26.0%; chi-square = 18.90, p < 0.001). Anxiety showed a similar pattern, affecting 75.5% of participants with PSU compared with

40.0% of participants classified as non-problematic users (chi-square = 19.90, p < 0.001). These findings demonstrated significant bivariate associations of PSU with both psychological outcomes.

Table 4: Association of sleep quality with depression and anxiety

Outcome	Sleep-quality category	Outcome absent n (%)	Outcome present n (%)	Chi-square	p value
Depression	Good sleep quality	50 (79.4%)	13 (20.6%)	37.99	<0.001
	Poor sleep quality	45 (31.7%)	97 (68.3%)		
Anxiety	Good sleep quality	42 (66.7%)	21 (33.3%)	43.88	<0.001
	Poor sleep quality	26 (18.3%)	116 (81.7%)		

Poor sleep quality was strongly associated with both depression and anxiety. Depression was present in 68.3% of participants with poor sleep compared with 20.6% of those with good sleep (chi-square =

37.99, $p < 0.001$). Anxiety was present in 81.7% of participants with poor sleep compared with 33.3% of those with good sleep (chi-square = 43.88, $p < 0.001$).

Table 5: Multivariable binary logistic regression for depression and anxiety

Outcome	Predictor	AOR	95% CI	p value
Depression	Problematic smartphone use	5.41	2.09-14.03	<0.001
	Poor sleep quality	9.66	4.05-23.07	<0.001
	Age (per year)	1.11	0.95-1.30	0.175
	Male sex (vs female)	1.25	0.64-2.43	0.516
	Physical activity (per 60 min/week)	1.00	0.78-1.27	0.977
	Caffeine intake (per cup/day)	1.34	0.98-1.82	0.063
	Bedtime use 30-60 min (vs <30)	1.42	0.43-4.69	0.570
	Bedtime use 61-120 min (vs <30)	0.46	0.13-1.66	0.234
	Bedtime use >120 min (vs <30)	0.86	0.21-3.50	0.838
Anxiety	Night-time notifications: Yes	0.60	0.30-1.19	0.143
	Problematic smartphone use	3.25	1.32-8.00	0.010
	Poor sleep quality	8.91	3.94-20.18	<0.001
	Age (per year)	0.90	0.76-1.06	0.186
	Male sex (vs female)	0.96	0.47-1.94	0.909
	Physical activity (per 60 min/week)	0.92	0.71-1.20	0.540
	Caffeine intake (per cup/day)	1.01	0.73-1.40	0.951
	Bedtime use 30-60 min (vs <30)	2.26	0.71-7.22	0.169
	Bedtime use 61-120 min (vs <30)	1.07	0.31-3.68	0.921
	Bedtime use >120 min (vs <30)	1.47	0.36-6.03	0.592
	Night-time notifications: Yes	0.82	0.39-1.72	0.603

AOR = adjusted odds ratio; CI = confidence interval. Both models were adjusted simultaneously for all predictors shown. Reference categories were non-problematic smartphone use, good sleep quality, female sex, bedtime smartphone use <30 minutes, and no night-time notifications. Depression model: McFadden pseudo-R² = 0.225, AUC = 0.798, overall model $p < 0.001$. Anxiety model: McFadden pseudo-R² = 0.229, AUC = 0.803, overall model $p < 0.001$.

After multivariable adjustment, PSU remained independently associated with depression (AOR 5.41, 95% CI 2.09-14.03; $p < 0.001$) and anxiety (AOR 3.25, 95% CI 1.32-8.00; $p = 0.010$). Poor sleep quality showed the largest adjusted association with both outcomes: participants with poor sleep had 9.66-fold higher adjusted odds of depression (95% CI 4.05-23.07; $p < 0.001$) and 8.91-fold higher adjusted odds of anxiety (95% CI 3.94-20.18; $p < 0.001$). None of the remaining covariates reached conventional statistical significance in either fully adjusted model.

DISCUSSION

This study identified a high burden of problematic smartphone use, poor sleep quality, depression, and anxiety among young adults. Three findings are central. First, 75.6% of participants met the study definition of PSU and 69.3% had poor sleep quality. Second, both depression and anxiety were significantly more common in participants with PSU and in those with poor sleep. Third, these relationships persisted after adjustment for demographic and lifestyle covariates. PSU was associated with 5.41-fold higher adjusted odds of

depression and 3.25-fold higher adjusted odds of anxiety, whereas poor sleep showed even larger adjusted associations with depression (AOR 9.66) and anxiety (AOR 8.91). Because the design was cross-sectional, these estimates describe independent associations rather than causal effects or temporal direction.

The observed PSU prevalence of 75.6% is high relative to several previously studied populations. The systematic review by Ratan et al,^[1] emphasized that prevalence estimates vary markedly according to population and measurement approach. Nikolic et al,^[4] reported smartphone addiction in 21.7% of medical students, while Amin et al,^[9] documented a substantially greater burden among Sudanese medical students. Ong et al,^[10] estimated a 34.0% prevalence of PSU in a household survey of Singapore adults. The higher proportion in the present sample may reflect the young age distribution, intensive integration of smartphones into education and social interaction, the scoring threshold applied in this study, and contextual differences in recruitment. Cross-study prevalence comparisons should therefore be made cautiously because apparently large differences can arise from instrument choice, cutoffs, and sample composition rather than from a true difference in underlying behavioral risk.

Poor sleep was also common, affecting 69.3% of participants, and it had the strongest independent relationship with both psychological outcomes. This result is consistent with evidence that the timing and context of smartphone use may be at least as important as total use. Chen et al,^[2] linked while-in-bed smartphone use with sleep delay and sleep quality, while Olivares-Guido et al,^[5] Su et al,^[6] and Zeyrek et al,^[7] each described sleep-related

correlates of problematic or night-time smartphone behavior in student populations. Mechanistic work by Wallinheimo and Evans,^[11] further connected circadian preference with problematic smartphone and social-media use in young adults. In the present dataset, more than half of participants reported at least 61 minutes of bedtime smartphone use, creating a plausible behavioral context in which delayed sleep opportunity, cognitive arousal, notifications, and irregular sleep timing may cluster. The adjusted analysis nevertheless indicates that poor sleep carried information about depression and anxiety beyond the binary PSU classification itself. The mental-health findings also align with the broader adult literature. Khan et al,^[3] reported progressively worse depression, anxiety, stress, and sleep scores with higher problematic smartphone-use categories, and Nikolic et al,^[4] similarly described co-occurrence of smartphone addiction with poor sleep, anxiety, and depression. Karila et al,^[12] extended the evidence base by examining problematic smartphone and social-media use among adults in France. Together, these studies support the interpretation that PSU should not be treated simply as a measure of time spent on a device. It is better understood as a pattern of use that can coexist with emotional symptoms, disrupted routines, and impaired self-regulation. The persistence of the PSU association after adjustment in the present study is therefore notable, although reverse causation remains possible: young adults experiencing depression or anxiety may also turn to smartphones more frequently for distraction, reassurance, social connection, or avoidance.

An important methodological consideration is the difference between problematic use and objectively measured exposure. Bild et al,^[13] reported that objectively measured overall smartphone screen use was not significantly associated with sleep or mental-health variables in their young-adult sample, despite associations between sleep-related impairment and emotional symptoms. Yin et al,^[14] using both smartphone-addiction measures and objective smartphone data, found that behavioral addiction constructs and very high device-recorded use can provide partly distinct information about sleep outcomes. This distinction helps explain why simple daily hours should not be interpreted as interchangeable with PSU. In the present study, mean daily use exceeded six hours, but the multivariable model focused on the prespecified PSU classification and sleep quality. Future work should combine validated behavioral scales with device logs to separate compulsive use, duration, timing, and patterns of unlocking or application use. The health relevance of excessive smartphone behavior is not limited to sleep and emotional symptoms. Phuyal et al,^[15] examined smartphone overuse in relation to neck and wrist/hand musculoskeletal pain among medical and nursing students. Although musculoskeletal outcomes were outside the present objectives, this broader evidence

suggests that PSU may cluster with multiple behavioral and physical consequences. From a preventive perspective, the implication is not that young adults should avoid smartphones, which are integral to education and communication, but that risk-reduction strategies should focus on dysfunctional use patterns, prolonged bedtime engagement, notification management, and maintenance of adequate sleep opportunity.

The strong association between poor sleep and psychological symptoms deserves particular attention. Saga et al,^[16] recently examined PSU, sleep quality, and chronotype among medical students and found sleep-related patterns to remain important after multivariable adjustment. The present results are compatible with a model in which sleep disturbance is not merely a downstream consequence of smartphone behavior but an independent correlate of emotional distress. Several pathways are plausible, including delayed sleep onset, shortened sleep duration, circadian misalignment, pre-sleep cognitive stimulation, and bidirectional reinforcement between distress and night-time device use. The cross-sectional design cannot determine which pathway predominates, but the size of the adjusted associations suggests that sleep assessment should accompany digital-wellbeing screening in young adults.

Recent studies also place PSU within a wider behavioral and psychosocial ecology. Vicente-Prieto et al,^[17] associated smartphone and internet addictive behaviors with Mediterranean diet adherence in young adults, while Manomenidis et al,^[18] examined PSU in relation to quality of life among nursing students. Toğuc,^[19] linked problematic digital-media use with eating behavior and obesity-related outcomes, and Li et al,^[20] synthesized evidence regarding smartphone addiction and suicidal ideation or suicide attempt. Alam et al,^[21] highlighted fear of missing out as a predictor of smartphone addiction and mental-health outcomes among university students, including links with late-night smartphone habits. These findings reinforce the likelihood that PSU is embedded in a network of sleep, emotional, social, and lifestyle factors. Accordingly, interventions that address only total screen time may be less useful than approaches that target bedtime routines, compulsive checking, social-media pressures, notification exposure, and access to psychological support.

The study has several strengths. It used a complete dataset of 205 young adults, applied explicit scoring thresholds for PSU, sleep quality, depression, and anxiety, and examined both crude associations and multivariable-adjusted estimates. The regression models showed acceptable discrimination, with AUC values of 0.798 for depression and 0.803 for anxiety. Reporting both prevalence and adjusted associations provides a more informative account than prevalence estimates alone. At the same time, several limitations should frame interpretation. A cross-sectional design cannot establish causality or

temporal sequence. The single-center hospital-based setting limits generalizability to community populations and to young adults in other educational or cultural contexts. The principal exposures and outcomes were self-reported and may be affected by recall, reporting, and common-method bias. Residual confounding may remain despite adjustment, particularly for variables such as academic stress, loneliness, socioeconomic circumstances, pre-existing mental-health symptoms, social-media intensity, and chronotype. The study-specific PSU scoring protocol may also limit direct comparison with investigations that used different instruments or thresholds.

Future studies should use longitudinal and multi-center designs to clarify the direction of association and to test whether changes in smartphone behavior precede changes in sleep and mental health. Device-recorded screen duration, unlock frequency, time-of-day use, and application categories should be combined with behavioral PSU scales. Objective sleep measures such as actigraphy could reduce common-method bias, while mediation analyses could examine whether sleep quality partly explains the relationship between PSU and depression or anxiety. Intervention studies could test practical strategies such as reduced bedtime use, notification curfews, digital-wellbeing counseling, and structured sleep-hygiene programs. Such work would help distinguish modifiable behavioral targets from markers of underlying psychological distress.

CONCLUSION

Problematic smartphone use and poor sleep quality were highly prevalent among the 205 young adults studied and were independently associated with depression and anxiety. After adjustment for age, sex, physical activity, caffeine intake, bedtime smartphone use, and night-time notifications, PSU remained associated with higher odds of depression and anxiety, while poor sleep quality showed the strongest adjusted associations with both outcomes. These findings support integrated assessment of digital-use patterns, sleep health, and psychological symptoms in young adults. Because the study was cross-sectional and single-center, causal interpretation is not appropriate; longitudinal and multi-center research using both validated questionnaires and objective device and sleep measures is warranted.

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