

# Association Between Smartphone Usage, Quality of Life, and Sleep Duration Among University Students

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## ABSTRACT

**Background:** Problematic smartphone use and sleep disturbance may adversely affect university students' well-being, but evidence examining these factors concurrently in Pakistani students remains limited. **Objective:** To determine the associations among smartphone use, quality of life, and sleep-related outcomes in university students in Lahore, Pakistan. **Methods:** This analytical cross-sectional study included 218 students recruited through convenience sampling from three universities. Smartphone use, quality of life, and sleep were assessed using the Smartphone Addiction Scale–Short Version, World Health Organization Quality of Life–Brief Version, and Pittsburgh Sleep Quality Index, respectively. Descriptive statistics and Spearman's rank correlations were calculated. **Results:** Most participants were aged 22–24 years (59.6%), and smartphone-use categories were broadly distributed across low, moderate, high, and very high levels. Overall quality of life was rated as good or very good by 172 participants (78.9%), while 158 (72.5%) reported very good or fairly good subjective sleep quality. Smartphone-use scores were weakly and inversely associated with quality-of-life scores ( $\rho = -0.151$ ,  $p = 0.026$ ) but were not associated with sleep-quality scores ( $\rho = 0.056$ ,  $p = 0.410$ ). Poorer sleep quality was associated with lower quality of life ( $\rho = -0.216$ ,  $p = 0.001$ ). **Conclusion:** Greater smartphone use was weakly associated with poorer quality of life, while sleep quality showed no significant association with smartphone use. Sleep remained significantly related to overall well-being. **Keywords:** Smartphone Use; Quality of Life; Sleep Quality; University Students; Digital Health; Pakistan.

## INTRODUCTION

Smartphones have become integral to university education and student life, supporting communication, access to academic resources, social interaction, entertainment, navigation, and routine daily activities. Although these functions can facilitate learning and connectivity, frequent and poorly regulated smartphone use may interfere with academic engagement, physical activity, face-to-face interaction, and psychological well-being. Previous research has generally demonstrated an inverse relationship between excessive smartphone use and academic performance, although the magnitude and consistency of this association vary across populations and measurement approaches (1,2).

Problematic smartphone use, frequently described as smartphone addiction, is characterized by compulsive use, impaired control, withdrawal-like symptoms, tolerance, and continued use despite adverse consequences. Although it is not formally classified as an independent psychiatric disorder, it shares behavioural features with recognized addictive patterns (3). University students may be particularly vulnerable because of academic pressure, increased independence, social-media engagement, fear of missing out, and the routine integration of digital devices into educational activities. A systematic review reported considerable variation in the prevalence of problematic smartphone use

among young people, reflecting differences in instruments, thresholds, populations, and cultural contexts (4). High levels of smartphone addiction have also been documented among university students in Middle Eastern settings (5).

Quality of life is a multidimensional construct encompassing physical health, psychological well-being, social relationships, environmental conditions, independence, and overall life satisfaction. Excessive smartphone use may reduce quality of life by displacing health-promoting activities, impairing self-regulation, increasing psychological distress, and limiting meaningful social interaction (6). Prolonged smartphone use has also been associated with sedentary behaviour, musculoskeletal symptoms, reduced physical activity, and adverse mood and sleep outcomes, which may collectively influence perceived well-being (7).

Sleep is another important determinant of physical, emotional, and cognitive functioning among university students. Adults are generally advised to obtain at least seven hours of sleep per night, while seven to nine hours is considered appropriate for most young adults (8,9). Nevertheless, university students commonly experience irregular sleep schedules because of academic demands, social activities, psychological stress, shared accommodation, and nighttime technology use. Problematic smartphone use may contribute to delayed sleep onset, reduced sleep duration, daytime dysfunction, and poorer subjective sleep quality through prolonged screen exposure, cognitive arousal, notifications, and displacement of bedtime (10). Studies from different university populations have reported associations between excessive screen exposure, smartphone addiction, sleep disturbance, and adverse mental-health outcomes (11,12).

Quality of life and sleep may also be closely interconnected. Poor sleep can impair concentration, emotional regulation, physical functioning, academic performance, and social participation, while psychological distress and reduced well-being can further disrupt sleep. Previous research suggests that sleep may represent an important pathway through which digital overuse affects student well-being (13). However, much of the existing evidence has originated from East Asian, European, North American, and Middle Eastern populations. Pakistani research has primarily examined smartphone use in relation to academic performance or self-regulation, while evidence simultaneously evaluating smartphone use, quality of life, and sleep-related outcomes remains limited (14).

Therefore, this study aimed to determine the associations between smartphone usage, quality of life, and sleep-related outcomes, including sleep quality and duration, among university students in Lahore, Pakistan. It was hypothesized that greater smartphone usage would be associated with poorer quality of life and less favourable sleep outcomes.

## **MATERIALS AND METHODS**

An analytical cross-sectional study was conducted among undergraduate and postgraduate students enrolled at the University of Lahore, Lahore College for Women University, and Lahore University of Management Sciences in Lahore, Pakistan. The target population comprised male and female university students aged 18–30 years. Participants were recruited through a non-probability convenience-sampling technique according to their availability during the data-collection period.

The required sample size was calculated using an anticipated prevalence of 6%, a 95% confidence level, and a 3.15% margin of error, producing a final target of 218 participants (14). Students were eligible when they were currently enrolled at one of the participating universities, were between 18 and 30 years of age, and provided informed consent. Students with a diagnosed neurological disorder or substantial cognitive impairment that could independently affect their sleep or quality of life were excluded. Incomplete and duplicate responses were also excluded from the final analysis.

Data were collected using a structured questionnaire comprising demographic information and standardized measures of smartphone use, quality of life, and sleep. Demographic variables included

age, sex, educational status, socioeconomic status, and university affiliation. Smartphone use was assessed using the Smartphone Addiction Scale–Short Version, a self-report measure developed to evaluate symptoms of problematic smartphone engagement (15). For descriptive presentation, smartphone-use scores were classified into low, moderate, high, and very high categories according to the scoring approach applied in the study dataset.

Quality of life was assessed using the 26-item World Health Organization Quality of Life–Brief Version. The instrument measures four principal domains: physical health, psychological well-being, social relationships, and environmental quality of life. Items are rated using five-point response scales, with higher scores representing more favourable quality of life (16). Sleep was evaluated using the Pittsburgh Sleep Quality Index, which contains 19 self-reported items organized into seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. Component scores range from 0 to 3 and contribute to a global score ranging from 0 to 21, with higher scores indicating poorer sleep quality (12).

Hard-copy questionnaires were administered to students at the University of Lahore, whereas electronic questionnaires were distributed through Google Forms to participants from Lahore College for Women University and Lahore University of Management Sciences. All participants received an explanation of the study objectives, voluntary nature of participation, confidentiality protections, and right to withdraw without penalty. The same eligibility criteria, questionnaire sequence, and standardized measurement instruments were applied across the participating institutions. Responses were reviewed for completeness and duplication before being entered into the statistical database.

The study was conducted under the ethical guidance of the Ethics Committee of the University of Lahore. Informed consent was obtained from every participant before data collection. Participation was voluntary, personally identifying information was not included in the analysis or reporting, and collected data were maintained confidentially.

Data were analysed using IBM SPSS Statistics version 26.0. Categorical variables were summarized as frequencies and percentages, while continuous scale scores were presented as means and standard deviations. Responses were screened before analysis, and incomplete or duplicate questionnaires were excluded rather than imputed. Spearman's rank correlation coefficient was used to determine the direction and strength of the associations among smartphone-use scores, quality-of-life scores, and sleep-quality scores. All statistical tests were two-sided, and a p-value below 0.05 was considered statistically significant.

## RESULTS

All 218 participants were included in the analysis. Most participants were aged 22–24 years (59.6%), were enrolled at the University of Lahore (71.6%), and reported a middle socioeconomic status (50.9%). Smartphone-use categories were relatively evenly distributed, although moderate use was the most frequent category (27.5%), followed by very high use (25.2%) (Table 1).

*Table 1. Participant Characteristics and Smartphone-Use Categories (N = 218)*

| Characteristic       | Category                                 | n (%)      |
|----------------------|------------------------------------------|------------|
| Age group            | 18–21 years                              | 74 (33.9)  |
|                      | 22–24 years                              | 130 (59.6) |
|                      | 25–27 years                              | 14 (6.4)   |
|                      | ≥28 years                                | 0 (0.0)    |
| University           | University of Lahore                     | 156 (71.6) |
|                      | Lahore College for Women University      | 16 (7.3)   |
|                      | Lahore University of Management Sciences | 46 (21.1)  |
| Socioeconomic status | Upper                                    | 33 (15.1)  |
|                      | Middle                                   | 111 (50.9) |
|                      | Lower                                    | 74 (33.9)  |

| Characteristic          | Category  | n (%)     |
|-------------------------|-----------|-----------|
| Smartphone-use category | Low       | 53 (24.3) |
|                         | Moderate  | 60 (27.5) |
|                         | High      | 50 (22.9) |
|                         | Very high | 55 (25.2) |

Most participants reported favourable overall quality of life (78.9%) and favourable health ratings (67.9%). Approximately 58.3% reported enjoying life to a high degree, while 50.0% reported a high sense of meaningfulness. More than half reported high perceptions of daily safety, and 58.7% were satisfied or very satisfied with their ability to work. Concentration and energy ratings were more frequently concentrated in the intermediate categories (Table 2).

*Table 2. Summary of Principal Quality-of-Life Indicators (N = 218)*

| Quality-of-Life Indicator         | Low or Unfavourable, n (%) | Intermediate, n (%) | High or Favourable, n (%) |
|-----------------------------------|----------------------------|---------------------|---------------------------|
| Overall quality of life           | 6 (2.8)                    | 40 (18.3)           | 172 (78.9)                |
| Satisfaction with health          | 23 (10.6)                  | 47 (21.6)           | 148 (67.9)                |
| Enjoyment of life                 | 22 (10.1)                  | 69 (31.7)           | 127 (58.3)                |
| Meaningfulness of life            | 31 (14.2)                  | 78 (35.8)           | 109 (50.0)                |
| Ability to concentrate            | 39 (17.9)                  | 96 (44.0)           | 83 (38.1)                 |
| Safety in daily life              | 28 (12.8)                  | 78 (35.8)           | 112 (51.4)                |
| Energy for daily life             | 33 (15.1)                  | 82 (37.6)           | 103 (47.2)                |
| Satisfaction with ability to work | 16 (7.3)                   | 74 (33.9)           | 128 (58.7)                |

Five-point responses were collapsed into low/unfavourable, intermediate, and high/favourable categories.

Approximately half of the participants were satisfied or very satisfied with their sleep (49.5%), while 72.5% rated their subjective sleep quality as very good or fairly good. Nevertheless, specific sleep disturbances were common. Difficulty initiating sleep, nocturia, night or early-morning awakening, and pain-related sleep disturbance occurred three or more times per week in approximately one-fifth to one-quarter of the sample. Daytime sleepiness at least once per week was reported by 31.2%, and 20.6% used sleep medication at least once per week (Table 3).

*Table 3. Summary of Principal Sleep-Related Findings (N = 218)*

| Sleep Indicator                    | Category or Frequency              | n (%)      |
|------------------------------------|------------------------------------|------------|
| Satisfaction with sleep            | Satisfied or very satisfied        | 108 (49.5) |
|                                    | Neither satisfied nor dissatisfied | 73 (33.5)  |
|                                    | Dissatisfied or very dissatisfied  | 37 (17.0)  |
| Subjective sleep quality           | Very good or fairly good           | 158 (72.5) |
|                                    | Fairly bad or very bad             | 60 (27.5)  |
| Difficulty initiating sleep        | ≥3 times per week                  | 51 (23.4)  |
| Night or early-morning awakening   | ≥3 times per week                  | 49 (22.5)  |
| Nocturia-related sleep disturbance | ≥3 times per week                  | 52 (23.9)  |
| Pain-related sleep disturbance     | ≥3 times per week                  | 47 (21.6)  |
| Bad dreams                         | ≥3 times per week                  | 39 (17.9)  |
| Daytime difficulty staying awake   | ≥1 time per week                   | 68 (31.2)  |
| Difficulty maintaining enthusiasm  | ≥1 time per week                   | 70 (32.1)  |
| Use of sleep medication            | ≥1 time per week                   | 45 (20.6)  |

*Table 4. Spearman Correlations Among Smartphone Use, Quality of Life, and Sleep Quality (N = 218)*

| Variable Pair                                  | Spearman's $\rho$ | p-Value |
|------------------------------------------------|-------------------|---------|
| Smartphone-use score and quality-of-life score | -0.151            | 0.026   |
| Smartphone-use score and PSQI score            | 0.056             | 0.410   |
| Quality-of-life score and PSQI score           | -0.216            | 0.001   |

PSQI: Pittsburgh Sleep Quality Index. Higher PSQI scores represent poorer sleep quality. Statistical significance was set at  $p < 0.05$ .

Spearman correlation analysis demonstrated a weak but statistically significant inverse association between smartphone-use scores and quality-of-life scores ( $\rho = -0.151$ ,  $p = 0.026$ ). Smartphone use was not significantly associated with PSQI scores ( $\rho = 0.056$ ,  $p = 0.410$ ). A weak inverse association was found

between quality-of-life and PSQI scores ( $\rho = -0.216$ ,  $p = 0.001$ ), indicating that poorer sleep quality was associated with lower quality of life (Table 4).

## DISCUSSION

This study examined the relationships among smartphone use, quality of life, and sleep-related outcomes in university students from three institutions in Lahore. Smartphone use demonstrated a weak inverse association with quality of life, indicating that participants with higher smartphone-use scores tended to report slightly poorer quality of life. No statistically significant association was observed between smartphone use and sleep quality. In contrast, poorer sleep quality was significantly associated with lower quality of life. These findings suggest that smartphone engagement and sleep may relate differently to student well-being and should not be treated as interchangeable indicators of digital or psychological health.

The inverse association between smartphone use and quality of life is consistent with previous evidence linking problematic smartphone engagement with impaired self-regulation, psychological distress, reduced physical activity, musculoskeletal symptoms, and poorer academic or social functioning (2,5-7). Shek et al. similarly reported that intensive internet gaming and social-media use were associated with poorer physical activity, sleep, quality of life, and academic outcomes among university students (13). The relationship observed in the present study was statistically significant but weak, suggesting that smartphone use represents only one of several factors associated with students' perceived well-being. Academic workload, mental health, financial circumstances, social support, physical health, and living conditions may also influence quality-of-life scores.

Most participants reported favourable overall quality of life, positive health ratings, and relatively high satisfaction with work capacity, safety, and enjoyment of life. These generally positive ratings do not contradict the inverse correlation with smartphone use. A correlation reflects differences across the range of scores rather than indicating that all participants with greater smartphone use necessarily experience poor quality of life. Smartphone use may exert a modest cumulative influence through displacement of physical activity, direct social interaction, academic engagement, and restorative behaviours rather than producing an immediate or uniformly severe reduction in well-being (6,7,13).

The absence of a significant association between smartphone use and sleep quality differs from several studies reporting that problematic smartphone use, internet addiction, or prolonged screen exposure is associated with insomnia, delayed sleep, and poorer subjective sleep quality (10-12,17). This discrepancy may reflect differences in study populations, cultural context, smartphone-use measures, sleep assessment, exposure timing, and statistical adjustment. The present study assessed overall smartphone-use severity but did not objectively measure screen time or distinguish daytime use from use immediately before sleep. Bedtime exposure, notification frequency, social-media activity, and emotionally stimulating content may be more directly related to sleep disruption than total smartphone-use scores.

Although most participants rated their subjective sleep quality positively, notable proportions reported recurrent difficulty initiating sleep, nocturia, night or early-morning awakening, pain-related sleep disturbance, daytime sleepiness, and reduced enthusiasm. This pattern indicates that a favourable overall sleep rating can coexist with specific sleep-related difficulties. Established recommendations emphasize the importance of adequate and regular sleep for adult physical, cognitive, and psychological health (8,9). The significant relationship between poorer sleep quality and lower quality of life in the present study is consistent with evidence that sleep disturbance can impair mood, concentration, physical functioning, social participation, and academic performance (11,13).

The study included students from three major universities and simultaneously evaluated smartphone use, quality of life, and sleep using structured instruments. However, its cross-sectional design prevents

conclusions about temporal sequence or causality. Convenience sampling may have introduced selection bias, and the predominance of participants from the University of Lahore limits representativeness across institutions. Smartphone use and sleep were assessed through self-report rather than objective screen-time or sleep-monitoring methods, creating potential recall and social-desirability bias. The analyses were unadjusted, and residual confounding by academic stress, mental health, physical activity, accommodation, and socioeconomic factors cannot be excluded.

The findings support university health initiatives that address digital self-regulation and sleep health as related but distinct components of student well-being. Interventions should emphasize responsible smartphone use, awareness of bedtime digital habits, sleep-hygiene education, and access to psychological support. Future longitudinal studies should employ objective screen-time measures, distinguish academic from recreational smartphone use, assess bedtime exposure, report PSQI component and global scores using validated scoring procedures, and use multivariable analyses to identify independent associations.

## CONCLUSION

Higher smartphone-use scores were weakly associated with lower quality of life among university students, whereas smartphone use was not significantly associated with sleep quality. Poorer sleep quality was independently correlated with lower quality of life, highlighting sleep as an important component of student well-being. These findings support integrated university programmes promoting digital self-regulation and healthy sleep practices, while longitudinal and objectively measured studies are required to clarify the direction and clinical importance of these relationships.

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