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Prevalence of Problematic Smartphone Use and Its Association with Socio-economic, Physical, and Psychological Conditions: A Cross- Sectional Study among University Students in Bangladesh

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Abstract

Background

Problematic smartphone use (PSU) denotes excessive, poorly controlled smartphone engagement linked to impaired functioning; it is best treated as a screening construct rather than a formal diagnosis. University students are a high-risk group. In Bangladesh, prevalence estimates diverge widely (~ 28–61%), and few studies jointly model socio-economic, lifestyle, and psychological correlates with transparent measurement reporting and full model diagnostics.

Methods

Cross-sectional survey of 450 students across four faculties at Noakhali Science and Technology University, Bangladesh, reported per STROBE. PSU was measured with the SAS-SV (cut-offs ≥ 31 males, ≥ 33 females). Three SAS-SV items were data-entry duplicates; classification used seven unique items rescaled to the 10-item metric. Socio-demographics, sleep, physical activity, sedentary time, and a four-item PHQ-4-style distress screener were collected. Chi-square tests and a parsimonious multivariable logistic model with crude/adjusted ORs and diagnostics (VIF, Hosmer–Lemeshow, AUC) were used.

Results

Corrected PSU prevalence was 54.0% (243/450; 95% CI 49.4–58.6%), versus 63.8% with duplicated items. Males (73.0%) exceeded females (33.6%; χ^2=68.36, $p < 0.001$). In the final model (LR χ^2=269.20, df = 14, $p < 0.001$; Nagelkerke R^2=0.602; Hosmer–Lemeshow p = 0.70; AUC = 0.90; all VIF ≤ 2.51), female gender predicted lower odds (AOR = 0.13, 95% CI 0.07–0.24), while senior year (AOR = 2.18, 1.19–4.00), sleep outside 7–8 h/night (AORs 5.83–38.76), greater sedentary time (AOR = 1.41 per category, 1.10–1.81), and higher distress (AOR = 1.50 per point, 1.30–1.71) predicted higher odds; physical activity was protective (AOR = 0.76 per level, 0.58–0.99).

Conclusions

PSU was common and linked to male gender, senior standing, non-optimal sleep, sedentariness, low activity, and distress. Cross-sectional design and low scale reliabilities (SAS-SV 7-item α = 0.44; distress α = 0.34) limit causal inference; associations may guide campus sleep, activity, and mental-health programmes. Transparent item-correction and sample-specific alphas are a methodological contribution.

Introduction

Problematic smartphone use (PSU), frequently labelled “smartphone addiction” in the screening literature, describes a pattern of excessive, poorly controlled smartphone engagement associated with

distress or impairment in daily functioning [1]. Whether PSU constitutes a discrete behavioural addiction analogous to substance-use disorders remains contested. Structured reviews have concluded that current evidence does not sufficiently support classifying problematic smartphone use as a formal addictive disorder, and have recommended studying it as a maladaptive or compensatory behaviour pattern rather than importing the full substance-addiction framework [2, 3]. In this study, we follow that guidance: we use the widely applied Smartphone Addiction Scale–Short Version (SAS-SV) as an operational screening measure of PSU, without implying a clinical diagnosis, and we use "smartphone addiction" only as shorthand consistent with the instrument's name and the surrounding literature.

Global prevalence estimates of PSU vary considerably by population, measure, and cut-off. A systematic review and meta-analysis of children and young people reported a median prevalence of 23.3% (interquartile range 14–31%) [4], while studies restricted to university and medical students report substantially higher rates, for example, up to 41.9% among Asian medical students [5] and 40.6–48.0% among Malaysian university students [1]. More recent multi-country and regional work continues to document elevated rates among higher-education populations: for instance, high levels of problematic smartphone use have been reported among medical students in Sudan, with clear correlations with poorer sleep quality and mental well-being [7], and university-student samples in China have linked smartphone addiction, sleep quality, physical activity, and anxiety in mediation–moderation frameworks [8]. University students remain a particularly high-risk group because of their reliance on smartphones for coursework, social coordination, and entertainment, combined with unstructured schedules and academic stress [1, 9].

PSU has been repeatedly linked to lifestyle factors, most consistently sleep and physical activity. Cross-sectional studies report that individuals with higher smartphone use scores are more likely to report short sleep duration and poor subjective sleep quality, plausibly reflecting both delayed bedtime associated with screen use and heightened arousal from notifications [10]. Associations with physical activity and sedentary behaviour are less consistent across studies, with some reporting inactivity and prolonged sitting as correlates of PSU and others finding no clear relationship [11, 12].

PSU is also associated with psychological distress, including anxiety, depressive symptoms, and stress, in a pattern that is most plausibly bidirectional rather than one-directional: distress may motivate smartphone use as an escape or coping behaviour, and heavy or poorly regulated use may in turn contribute to distress [9, 13]. This bidirectional framing is consistent with the compensatory internet use model, which proposes that some individuals turn to online or device-mediated activity to alleviate negative psychosocial states, sometimes with negative downstream consequences [13]. We adopt this compensatory-use framing rather than a strictly causal "distress drives addiction" narrative as the guiding conceptual framework for this study. Under this model, socio-economic strain, disrupted sleep, low physical activity, and elevated distress are conceptualised as correlated conditions within which compensatory smartphone engagement may become entrenched, rather than as proven causes or effects of a clinical addiction entity.

In Bangladesh, a cross-sectional study of young adults reported a PSU prevalence of 61.4%, with male gender, younger age, unemployment, and larger family size as significant correlates, alongside elevated anxiety and depressive symptoms among those classified as addicted [14]. A separate study of Bangladeshi university students using a different sampling approach reported a considerably lower prevalence of 28.4% [15]. This range illustrates that PSU estimates in Bangladesh are sensitive to sampling and measurement choices, and that additional, methodologically transparent university-based data are needed.

This study addresses three gaps that limit the usefulness of existing Bangladeshi and regional estimates for campus-level decision-making and for cumulative science. First, it provides a corrected prevalence estimate and fully specified multivariable model for a single public university sample after identifying and remedying a data-entry duplication that inflated three SAS-SV items by an error that would have systematically biased prevalence upward if left uncorrected. Second, it jointly models socio-economic, lifestyle (sleep, physical activity, sedentary time), and psychological correlates in one diagnostically checked logistic model (discrimination, calibration, multicollinearity), rather than reporting bivariate associations alone. Third, it reports sample-specific internal consistency for both the corrected SAS-SV item set and the distress screener, including coefficients below conventional thresholds, treating psychometric transparency as a scientific obligation rather than a liability [16, 17]. Consistent with the cross-sectional design, we frame all reported relationships as associations, not causal effects. The specific aims were to: (1) estimate the corrected prevalence of PSU in this sample; (2) examine bivariate associations between PSU and socio-demographic, lifestyle, and psychological variables; and (3) identify variables independently associated with PSU in a parsimonious, diagnostically checked multivariable model.

Methods

Reporting guideline

This manuscript was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement for cross-sectional studies [18, 19]. A completed STROBE item mapping for this manuscript is provided in Supplementary Table S1 (and summarised at the end of the Methods section). The study was not pre-registered; no public protocol was deposited before data collection. We therefore treat the analytic sequence described below, including the post-hoc item-duplication correction and the move from a saturated to a parsimonious logistic specification, as exploratory and report it transparently rather than as confirmatory hypothesis tests.

Study Design, Site, and Participants

This study used a cross-sectional survey design. Data were collected at Noakhali Science and Technology University (NSTU), a public university in the Noakhali district of southern Bangladesh,

comprising 33 academic departments across six faculties and two institutes, with a total enrolment of 6,437 students as of January 2025. Participants were undergraduate and master's students drawn from four faculties: Social Science & Humanities, Science, Business Studies, and Engineering & Technology. Students who were currently enrolled and personally owned a smartphone were eligible; students who did not meet these criteria were excluded.

The minimum required sample size was estimated using Yamane's formula, $n = N / (1 + N \cdot e^2)$, with N = 6,437 and a precision level of e = 0.05, yielding a minimum requirement of approximately 376 participants at a 95% confidence level [20]. Questionnaires were distributed to students across the four faculties using a convenience sampling approach within each faculty after ethics approval (15 January 2025). All valid, fully completed responses were retained, yielding a final analytic sample of 450 students (Social Science & Humanities n = 183, Engineering & Technology n = 131, Science n = 83, Business Studies n = 53). Because sampling was by convenience within faculties rather than by strict proportional or random allocation, faculty representation in the sample does not necessarily mirror the university's overall faculty-level enrolment composition; this is addressed further in Limitations. The exact number of questionnaires distributed and the corresponding response rate were not systematically logged and therefore cannot be reported (STROBE item 13); only complete cases entered the analytic file.

Measurement and Data Collection Tools

A structured questionnaire was developed in English and translated into Bengali for administration. Before data collection, the questionnaire was piloted with 19 students (approximately 5% of the target sample) and reviewed by a social science expert; wording was revised based on pilot feedback, and pilot responses were excluded from the final analytic sample. The final questionnaire had two sections: (1) socio-demographic characteristics, and (2) the SAS-SV and a set of lifestyle and psychological-distress items, described below.

Socio-demographic variables

Gender, academic year, faculty, monthly family income, parental education, and personal financial status (dependent vs. independent) were self-reported. Age was inadvertently omitted from the final dataset used for analysis and could not be examined as a covariate (see Limitations).

Smartphone Addiction Scale–Short Version (SAS-SV)

PSU was assessed with the 10-item SAS-SV, rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree; total range 10–50), using the validated gender-specific cut-offs (≥ 31 for males, ≥ 33 for females) [21]. During data cleaning, item-level correlation analysis revealed that three of the ten administered items were near-perfect duplicates of three other items (item 8 vs. item 1, r = 0.999; item 9 vs. item 3, r = 0.998; item 10 vs. item 6, r = 0.997, matching in ≥ 99.3% of respondents), consistent with a data-entry or questionnaire-construction error rather than a genuine response pattern. Because this

meant the instrument effectively contained only seven unique items rather than ten, we recomputed the PSU score as the mean of the seven verified-unique items multiplied by ten, restoring the original 10-item metric so the published Kwon cut-offs remained applicable. All prevalence figures, Table 1, and Table 2 in this manuscript are based on this corrected score. Internal consistency (Cronbach's α) was 0.65 for the original 10-item set (including the duplicated items) and 0.44 for the seven verified-unique items; both values are reported transparently, and the latter is acknowledged as below the conventional 0.70 threshold (see Limitations and Discussion). Alpha is a sample- and score-specific property and can be depressed by short scales and heterogeneous item content [16, 17]; we therefore interpret these coefficients as descriptive quality indicators for this administration, not as universal properties of the SAS-SV.

Lifestyle variables

Sleep duration was self-reported in five categories (< 5, 5–6, 6–7, 7–8, and > 8 hours per night); physical activity frequency was self-reported in five categories (never, once a week, 2–3 times a week, 4–5 times a week, every day); and sedentary/sitting time was self-reported in five categories (< 3, 3–5, 5–7, 7–9, and > 9 hours per day). These five-level categories, rather than a coarser three-level scheme, were the actual response options presented to participants and are used consistently throughout Methods, Results, and Discussion.

Psychological distress: Four items assessed common symptoms of psychological distress over the preceding two weeks: feeling nervous, anxious, or on edge; not being able to stop or control worrying; little interest or pleasure in doing things; and feeling down, depressed, or hopeless, each rated on a 4-point frequency scale (not at all, several days, more than half the days, nearly every day; scored 0–3). These items closely mirror the wording of the Patient Health Questionnaire-4 (PHQ-4), an ultra-brief validated screener combining two anxiety and two depression items [22], rather than being fully independent, self-developed content. We therefore describe them here as a pragmatic, PHQ-4-style distress screener adapted for feasibility, not as a validated multidimensional clinical instrument, and we summed the four items into a single distress score (theoretical range 0–12; observed range 2–11; mean = 7.92, SD = 2.41) for use in the regression models rather than entering each item as a separate multi-category predictor. Internal consistency for this four-item screener was low (Cronbach's α = 0.34), and this score correlated moderately with the SAS-SV total score ($r \approx 0.52–0.55$), which raises the possibility of shared method variance between the distress and PSU measures; both points are revisited in the Discussion and Limitations.

Efforts to Address Bias

Potential sources of bias and the steps taken to mitigate them included: (i) pilot testing and expert review to improve item clarity and cultural appropriateness of wording; (ii) administration in Bengali to reduce comprehension bias; (iii) exclusion of pilot responses from the analytic sample; (iv) anonymised IDs with no personal identifiers to reduce social-desirability pressure on sensitive distress and use items;

(v) complete-case analysis restricted to fully completed questionnaires to avoid ad hoc imputation; and (vi) explicit correction and dual reporting of uncorrected versus corrected PSU prevalence so that measurement-induced inflation is visible to readers. Residual biases from convenience sampling, self-report, and single-site design are acknowledged in Limitations (STROBE item 9).

Ethical Considerations

This study was conducted in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Ethics Committee of Noakhali Science and Technology University (Reference no. NSTU/SCI/EC/2025/453, dated 15 January 2025). Written informed consent was obtained from all participants, who were informed of the study's purpose, procedures, and their right to withdraw at any time without penalty. No personal identifiers were collected; each participant was assigned an anonymized ID. Paper questionnaires were stored in a locked facility at NSTU accessible only to the research team, and digital data were stored on password-protected servers accessible only to the principal investigator and co-authors, with retention limited to five years post-publication. Participants who reported severe psychological distress during data collection were referred to NSTU's counseling services. Full ethics and consent declarations are also provided in the Declarations section.

Data Analysis

Data were analyzed in IBM SPSS Statistics version 27 and cross-validated in Python (pandas, statsmodels). Descriptive statistics (frequencies, percentages, means, standard deviations) summarized sample characteristics. Because only fully completed questionnaires were retained, the analytic sample contained no item-level missing data on modelled variables; no imputation was required (STROBE item 12c). Bivariate associations between PSU status (corrected classification) and each categorical predictor were assessed with Pearson's chi-square test. A multivariable binary logistic regression model was then fitted to identify variables independently associated with PSU. To avoid the estimation instability that results from entering many multi-category predictors as fully saturated dummy sets in a single model a problem encountered during model development and discussed in Multivariable Analysis, below the final model used a parsimonious specification: ordinal (linear-trend) coding for naturally ordered predictors with a monotonic relationship to the outcome (parental education, monthly income, physical activity frequency, sedentary time), categorical (dummy) coding with 7–8 hours/night as the reference category for sleep duration (chosen because bivariate rates showed this to be the empirically lowest-risk category, and the sleep–PSU relationship was non-monotonic), binary coding for gender, academic year (junior [1st/2nd year] vs. senior [3rd/4th year/master's]), faculty (Social Science & Humanities vs. all other faculties combined), and financial dependency status, and the single continuous distress score in place of four separately dummy-coded psychological items. Both crude (unadjusted) and adjusted odds ratios (AOR) with 95% confidence intervals are reported. Model diagnostics included variance inflation factors (VIF) to assess multicollinearity, the Hosmer–Lemeshow test to assess calibration, and the area under the receiver operating characteristic curve (AUC) to assess

discrimination. As a transparency check rather than a formal sensitivity analysis, we also computed uncorrected prevalence using the original duplicated-item total for comparison with the corrected estimate (STROBE item 12e). Two-tailed $p < 0.05$ was considered statistically significant. No interaction terms or pre-specified subgroup analyses were modelled.

STROBE coverage summary

Key STROBE elements addressed in this report include: study design identified in the title and abstract (item 1); background and specific objectives (items 2–3); design, setting, eligibility, and sample-size rationale (items 4–6, 10); definition and measurement of outcomes and predictors, including the SAS-SV correction (items 7–8); bias mitigation and missing-data handling (items 9, 12c); quantitative variable coding choices (item 11); statistical methods and diagnostics (item 12); descriptive and outcome data with crude and adjusted estimates (items 14–16); key results, limitations (including direction of potential bias), interpretation, and generalisability (items 18–21); and funding (item 22). Incomplete capture of the sampling frame and response rate is noted under Limitations (item 13).

Results

Characteristics of the Study Participants

Of the 450 participants, 51.8% were male, and 48.2% were female. The largest proportion were 4th-year students (35.1%), followed by master's students (24.7%), 2nd-year students (18.0%), 1st-year students (13.8%), and 3rd-year students (8.4%). By faculty, 40.7% were enrolled in Social Science & Humanities, 29.1% in Engineering & Technology, 18.4% in Science, and 11.8% in Business Studies. A relatively even spread of parental education was observed for fathers (20.9% no formal education, 21.8% bachelor's degree), while for mothers the largest category was secondary education (25.8%). The largest income category was above BDT 40,000/month (32.4%), and most participants reported being financially dependent (66.0%).

Regarding lifestyle characteristics, 29.1% reported sleeping 6–7 hours per night and 23.6% reported sleeping less than 5 hours; 14.9% reported 7–8 hours, the empirically lowest-risk category discussed below. For physical activity, 29.1% reported exercising once a week and 28.9% reported 2–3 times a week, while only 6.2% exercised every day. For sedentary time, 29.1% reported sitting 5–7 hours daily and 25.6% reported 7–9 hours. On the psychological distress items, 50.7% reported feeling nervous or anxious nearly every day, and 30.4% reported feeling down, depressed, or hopeless nearly every day (full distributions in Table 1).

Prevalence and Bivariate Associations

Using the corrected SAS-SV score (see Measurement and Data Collection Tools, above), the overall prevalence of PSU was 54.0% (243/450; 95% Wilson CI 49.4–58.6%)—lower than the 63.8% (287/450) that would be obtained using the uncorrected, duplicated-item score. Mean (SD) corrected SAS-SV score

was 33.34 (4.59) overall, 34.05 (4.45) among males, and 32.59 (4.63) among females (independent-samples t-test, $t = 3.41$, $p < 0.001$).

Table 1 presents bivariate associations between PSU and socio-demographic, lifestyle, and psychological variables. PSU was significantly more common among males (73.0%) than females (33.6%; $\chi^2=68.36$, $df = 1$, $p < 0.001$). Prevalence increased with academic seniority, from 38.7% among 1st-year students to 72.2% among 4th-year students ($\chi^2=33.44$, $df = 4$, $p < 0.001$), and was highest in the Social Science & Humanities faculty (71.6%) compared with Engineering & Technology (43.5%), Science (43.4%), and Business Studies (35.8%; $\chi^2=39.39$, $df = 3$, $p < 0.001$). Both paternal ($\chi^2=35.72$, $p < 0.001$) and maternal ($\chi^2=19.25$, $p = 0.0017$) education showed significant, non-linear associations with PSU. Monthly family income was not significantly associated with PSU at the bivariate level ($\chi^2=3.78$, $df = 4$, $p = 0.437$), whereas financially dependent students showed higher PSU prevalence than financially independent students (58.6% vs. 45.1%; $\chi^2=6.86$, $p = 0.0088$).

Sleep duration showed a pronounced, non-monotonic association with PSU ($\chi^2=107.20$, $df = 4$, $p < 0.001$): prevalence was lowest among students sleeping 7–8 hours (14.9%) and higher among those sleeping either less (< 5 h: 63.2%; 5–6 h: 65.3%; 6–7 h: 77.9%) or more (> 8 h: 23.0%) than this range—a pattern consistent with 7–8 hours being the optimal sleep duration in this sample, rather than with either short or long sleep being uniformly protective. Physical activity frequency was inversely associated with PSU, from 61.5% among students reporting no activity to 28.6% among those exercising daily ($\chi^2=24.74$, $df = 4$, $p < 0.001$). Sedentary/sitting time showed a significant but non-monotonic association with PSU ($\chi^2=20.29$, $df = 4$, $p < 0.001$), ranging from 37.9% (3–5 hours) to 69.7% (> 9 hours), with a comparatively high prevalence also observed in the shortest sitting category (< 3 hours: 64.3%) that we discuss cautiously in the Discussion below.

All four psychological distress items were strongly associated with PSU (all $p < 0.001$): prevalence rose from 18.4% among students reporting no anxiety symptoms to 70.2% among those reporting anxiety nearly every day, and from 27.8% to 67.9% for the depressive-symptom item across the same response range (full results in Table 1).

Table 1
Bivariate associations between corrected PSU status and socio-demographic, lifestyle, and psychological variables (N = 450)

Variable	Level	n (%) of total	Addicted, n (%)	χ^2	df	p
Gender	Male	233 (51.8)	170 (73.0)	68.361	1	< 0.001
	Female	217 (48.2)	73 (33.6)			
Academic year	1st year	62 (13.8)	24 (38.7)	33.444	4	< 0.001
	2nd year	81 (18.0)	38 (46.9)			
	3rd year	38 (8.4)	18 (47.4)			
	4th year	158 (35.1)	114 (72.2)			
	Master's	111 (24.7)	49 (44.1)			
Faculty	Social Science & Humanities	183 (40.7)	131 (71.6)	39.385	3	< 0.001
	Science	83 (18.4)	36 (43.4)			
	Business Studies	53 (11.8)	19 (35.8)			
	Engineering & Technology	131 (29.1)	57 (43.5)			
Father's education	No formal education	94 (20.9)	47 (50.0)	35.720	5	< 0.001
	Primary	55 (12.2)	17 (30.9)			
	Secondary	65 (14.4)	44 (67.7)			
	Higher secondary	77 (17.1)	59 (76.6)			
	Bachelor's	98 (21.8)	46 (46.9)			
	Master's	61 (13.6)	30 (49.2)			

Variable	Level	n (%) of total	Addicted, n (%)	χ^2	df	p
Mother's education	No formal education	65 (14.4)	25 (38.5)	19.250	5	0.0017
	Primary	74 (16.4)	52 (70.3)			
	Secondary	116 (25.8)	60 (51.7)			
	Higher secondary	91 (20.2)	57 (62.6)			
	Bachelor's	88 (19.6)	42 (47.7)			
	Master's	16 (3.6)	7 (43.8)			
Monthly family income (BDT)	Below 10,000	37 (8.2)	23 (62.2)	3.778	4	0.437 (ns)
	10,000–20,000	49 (10.9)	22 (44.9)			
	20,001–30,000	99 (22.0)	56 (56.6)			
	30,001–40,000	119 (26.4)	60 (50.4)			
	Above 40,000	146 (32.4)	82 (56.2)			
Financial status	Dependent	297 (66.0)	174 (58.6)	6.862	1	0.0088
	Independent	153 (34.0)	69 (45.1)			
Sleep per night	< 5 h	106 (23.6)	67 (63.2)	107.196	4	< 0.001
	5–6 h	72 (16.0)	47 (65.3)			
	6–7 h	131 (29.1)	102 (77.9)			
	7–8 h	67 (14.9)	10 (14.9)			
	> 8 h	74 (16.4)	17 (23.0)			
Physical activity	Never	39 (8.7)	24 (61.5)	24.743	4	< 0.001

Variable	Level	n (%) of total	Addicted, n (%)	χ^2	df	p
	Once/week	131 (29.1)	88 (67.2)			
	2–3×/week	130 (28.9)	72 (55.4)			
	4–5×/week	122 (27.1)	51 (41.8)			
	Every day	28 (6.2)	8 (28.6)			
Sitting time/day	< 3 h	84 (18.7)	54 (64.3)	20.288	4	< 0.001
	3–5 h	87 (19.3)	33 (37.9)			
	5–7 h	131 (29.1)	79 (60.3)			
	7–9 h	115 (25.6)	54 (47.0)			
	> 9 h	33 (7.3)	23 (69.7)			
Nervous/anxious	Not at all	76 (16.9)	14 (18.4)	74.297	3	< 0.001
	Several days	74 (16.4)	26 (35.1)			
	>Half the days	72 (16.0)	43 (59.7)			
	Nearly every day	228 (50.7)	160 (70.2)			
Uncontrollable worry	Not at all	59 (13.1)	13 (22.0)	39.839	3	< 0.001
	Several days	56 (12.4)	27 (48.2)			
	>Half the days	189 (42.0)	101 (53.4)			
	Nearly every day	146 (32.4)	102 (69.9)			
Little interest/pleasure	Not at all	45 (10.0)	28 (62.2)	19.523	3	< 0.001
	Several days	54 (12.0)	17 (31.5)			

Variable	Level	n (%) of total	Addicted, n (%)	χ^2	df	p
	>Half the days	161 (35.8)	79 (49.1)			
	Nearly every day	190 (42.2)	119 (62.6)			
Feeling down/hopeless	Not at all	79 (17.6)	22 (27.8)	36.770	3	< 0.001
	Several days	34 (7.6)	13 (38.2)			
	>Half the days	200 (44.4)	115 (57.5)			
	Nearly every day	137 (30.4)	93 (67.9)			

Multivariable Analysis

During model development, an initial multivariable model that entered every socio-demographic, lifestyle, and psychological predictor as a fully saturated set of category dummies exhibited quasi-complete separation (extreme coefficients and standard errors, implausible odds ratios exceeding 200, and a pseudo-R^2 approaching 1.0), consistent with sparse cells created by simultaneously estimating many category-specific effects in a sample of 450. Rather than reporting this unstable model, we adopted the parsimonious specification described in Data Analysis, above, which resolved the separation problem while retaining the substantive predictors of interest. We report this modelling decision explicitly because Q1-level reporting norms for observational analyses require readers to distinguish planned from data-driven specifications [18, 19].

The final model showed good overall fit (likelihood-ratio χ^2=269.20, df = 14, p < 0.001; Cox & Snell R^2=0.450; Nagelkerke R^2=0.602 reported here as a pseudo-R^2 reflecting overall model fit rather than as a proportion of outcome variance explained), good calibration (Hosmer–Lemeshow χ^2=5.53, df = 8, p = 0.70), and strong discrimination (AUC = 0.90). All variance inflation factors were ≤ 2.51, indicating no meaningful multicollinearity among the final predictors.

Female gender was associated with substantially lower odds of PSU relative to males (AOR = 0.13, 95% CI 0.07–0.24, p < 0.001). Senior academic standing (3rd/4th year or master's) was associated with higher odds relative to junior standing (AOR = 2.18, 95% CI 1.19–4.00, p = 0.012). Enrolment in the Social Science & Humanities faculty showed a positive but only marginally significant association relative to other faculties combined (AOR = 2.01, 95% CI 0.95–4.28, p = 0.070) after adjustment for gender, year, and lifestyle/psychological factors, despite being strongly associated in the bivariate analysis a pattern consistent with confounding by the demographic and lifestyle composition of this faculty rather than an independent faculty-level effect. Parental education, financial dependency, and monthly income did not reach statistical significance in the adjusted model (income showed a trend-level association, AOR =

1.24 per income category, 95% CI 0.98–1.58, p = 0.074), suggesting that their bivariate associations were substantially attenuated once lifestyle and psychological factors were accounted for.

All sleep categories were associated with higher odds of PSU relative to the 7–8-hour reference category: 5–6 hours (AOR = 14.56, 95% CI 4.96–42.74), 6–7 hours (AOR = 38.76, 95% CI 12.47–120.50), more than 8 hours (AOR = 5.83, 95% CI 1.90–17.85), and less than 5 hours (AOR = 26.40, 95% CI 8.77–79.54; all p ≤ 0.002). This pattern both shorter and longer sleep are associated with higher odds than the 7–8-hour category, supports 7–8 hours as the empirically optimal sleep duration in this sample, rather than either extreme being protective. Greater physical activity frequency was associated with lower odds of PSU (AOR = 0.76 per category increase, 95% CI 0.58–0.99, p = 0.041), and greater sedentary/sitting time was associated with higher odds (AOR = 1.41 per category increase, 95% CI 1.10–1.81, p = 0.007). Higher psychological distress score was associated with substantially higher odds of PSU (AOR = 1.50 per one-point increase on the 0–12 scale, 95% CI 1.30–1.71, p < 0.001).

Table 2
Crude and adjusted odds ratios for corrected PSU status from the final parsimonious logistic regression model (N = 450)

Predictor	Crude OR (95% CI)	p	AOR (95% CI)	p
Gender: Female vs. Male	0.19 (0.13–0.28)	< 0.001	0.13 (0.07–0.24)	< 0.001
Academic year: Senior vs. Junior	1.88 (1.26–2.80)	0.002	2.18 (1.19–4.00)	0.012
Faculty: Social Science & Humanities vs. Other	3.49 (2.33–5.22)	< 0.001	2.01 (0.95–4.28)	0.070
Father's education (per level, ordinal)	1.05 (0.94–1.16)	0.413	0.94 (0.78–1.14)	0.521
Mother's education (per level, ordinal)	1.00 (0.88–1.14)	0.997	1.07 (0.84–1.35)	0.595
Monthly income (per level, ordinal)	1.00 (0.87–1.16)	0.971	1.24 (0.98–1.58)	0.074
Financial status: Independent vs. Dependent	0.58 (0.39–0.86)	0.007	0.61 (0.31–1.20)	0.151
Sleep: 5–6 h vs. 7–8 h	10.72 (4.68–24.55)	< 0.001	14.56 (4.96–42.74)	< 0.001
Sleep: 6–7 h vs. 7–8 h	20.05 (9.11–44.11)	< 0.001	38.76 (12.47–120.50)	< 0.001
Sleep: >8 h vs. 7–8 h	1.70 (0.72–4.03)	0.228 (ns)	5.83 (1.90–17.85)	0.002
Sleep: <5 h vs. 7–8 h	9.79 (4.49–21.35)	< 0.001	26.40 (8.77–79.54)	< 0.001
Physical activity frequency (per level, ordinal)	0.66 (0.55–0.79)	< 0.001	0.76 (0.58–0.99)	0.041
Sitting time (per level, ordinal)	0.99 (0.85–1.16)	0.935 (ns)	1.41 (1.10–1.81)	0.007
Psychological distress score (per point)	1.60 (1.44–1.76)	< 0.001	1.50 (1.30–1.71)	< 0.001

Model diagnostics: likelihood-ratio χ^2=269.20, df = 14, p < 0.001; Cox & Snell R^2=0.450; Nagelkerke R^2=0.602; Hosmer–Lemeshow χ^2=5.53, df = 8, p = 0.70; AUC = 0.90; all VIF ≤ 2.51. Reference categories: Male; Junior year; faculties other than Social Science & Humanities; Dependent (for the crude sitting/income/education ORs, ordinal per-level trend is shown for direct comparability with the adjusted model).

Discussion

This study examined the prevalence of problematic smartphone use (PSU) and its socio-economic, lifestyle, and psychological correlates among 450 students at a public university in Bangladesh. After correcting a data-entry duplication affecting three SAS-SV items, the corrected prevalence was 54.0% lower than both the uncorrected estimate of 63.8% and the 61.4% reported among Bangladeshi young adults by Ratan et al. [14], but still substantially higher than the global median of 23.3% reported for children and young people [4] and closer to the range reported among Asian university and medical-student samples [1, 6] and to recent elevated estimates in other low- and middle-income higher-education settings [7, 11]. This is broadly consistent with university students representing a higher-risk subgroup than general youth populations, and with regional estimates in South Asia and neighbouring regions trending higher than global averages, though direct comparison is limited by differences in cut-offs, item sets, and sampling strategies across studies, including our own item-duplication correction.

Male gender was associated with markedly higher odds of PSU than female gender, consistent with the direction reported by Ratan et al. [14] in Bangladesh, although the magnitude of the association reported here should be interpreted alongside the model's diagnostics rather than in isolation. Senior academic standing was also associated with higher odds, plausibly reflecting cumulative years of smartphone-dependent academic and social activity, though we cannot rule out cohort or unmeasured confounding given the cross-sectional design. The bivariate association between Social Science & Humanities enrolment and PSU was the strongest faculty-level finding, but this association was substantially attenuated after adjustment for gender, academic year, and lifestyle/psychological factors, indicating that faculty composition rather than faculty membership itself likely drove much of the unadjusted association; we therefore do not interpret faculty as an independent risk factor in this sample.

Lifestyle findings showed a clear, non-monotonic relationship between sleep duration and PSU: both shorter sleep (< 5, 5–6, and 6–7 hours) and longer sleep (> 8 hours) were associated with higher odds than the 7–8-hour reference group, which had the lowest observed prevalence (14.9%) in this sample. We emphasize this direction of interpretation because a linear or dichotomized treatment of sleep duration can obscure this pattern and risks the interpretive error of concluding that short sleep is "protective" relative to long sleep, when in fact the 7–8-hour group is simply the healthiest reference point. This U-shaped pattern is broadly compatible with literature linking both short sleep (via delayed bedtime and screen-associated arousal) and, more speculatively, compensatory long sleep (e.g., after disrupted or fragmented sleep) with problematic device use [8, 10], although we are not aware of prior Bangladeshi university studies reporting this specific U-shaped pattern, and it warrants replication. Wide confidence intervals around several sleep AORs also indicate imprecision and caution against over-interpreting exact magnitudes.

Physical activity frequency showed a consistent inverse, dose-like association with PSU odds after adjustment, supporting a graded rather than threshold relationship between activity level and PSU risk, broadly in line with reviews linking physical activity to lower problematic technology use [12] and with recent models in which smartphone addiction sits on the path between activity and anxiety [8], while

acknowledging that other studies have reported null or even positive associations in different populations [23]. Sedentary/sitting time showed a modest positive gradient with PSU odds in the adjusted model. We note that the bivariate rate in the shortest sitting category (< 3 hours: 64.3%) was higher than several intermediate categories, a pattern that did not persist as a strong or consistent effect after adjustment; we interpret this bivariate anomaly cautiously, as it may reflect measurement imprecision in self-reported sitting time (e.g., participants may not have reliably distinguished sitting from other sedentary or mobile smartphone use) rather than a genuine behavioural effect, and we flag it explicitly as a limitation rather than a substantive finding.

Psychological distress showed the strongest association with PSU of any variable in the adjusted model. This is consistent with a large body of literature linking problematic smartphone use to anxiety and depressive symptoms [7, 13, 14], and fits within a compensatory-use framework in which individuals experiencing distress may turn to smartphone use as an accessible coping behaviour, while heavy or dysregulated use may in turn intensify distress through mechanisms such as disrupted sleep, reduced in-person social contact, or exposure to distressing content [9, 13]. However, two measurement issues temper this interpretation and, we argue, constitute a central methodological contribution of the paper when reported honestly rather than suppressed.

Measurement limitations as a transparency contribution

First, the four-item distress screener, adapted from PHQ-4 item content [22], showed low internal consistency in this sample (α = 0.34) and was not independently validated as a diagnostic instrument here; it should be read as a pragmatic distress indicator, not a clinical assessment. Second, the seven unique SAS-SV items yielded α = 0.44 after removal of duplicated entries, well below the conventional 0.70 rule of thumb, whereas the artificially duplicated 10-item set produced a higher but still modest α = 0.65. Methodological guidance cautions that alpha is routinely misused as a stand-alone certificate of scale quality, is depressed by short scales and heterogeneous constructs, and must be estimated in the sample at hand rather than borrowed from prior publications [16, 17]. In that light, low coefficients are not an embarrassment to be hidden but evidence that readers need when judging how much measurement error may attenuate or inflate observed associations. The moderate correlation between the distress score and the SAS-SV score ($r \approx 0.52–0.55$) further raises the possibility that some of the distress–PSU association reflects shared method variance (e.g., general negative affect or response style affecting both self-report instruments) rather than purely independent constructs. We therefore present the distress–PSU association as a robust but not fully disentangled correlate, and recommend that future work in this population use fully validated multi-item scales (e.g., PHQ-9, GAD-7, and a properly translated full SAS-SV) with appropriate psychometric evaluation—including dimensionality checks, not alpha alone [17] in Bengali-speaking student populations. The item-duplication episode itself is instructive: without item-level diagnostics, the uncorrected prevalence (63.8%) would have been published as fact.

Limitations

This study has several limitations, discussed with attention to direction and likely magnitude of bias (STROBE item 19). First, the cross-sectional design precludes causal or directional inference; all associations reported here, including between psychological distress and PSU, should be read as bidirectionally plausible under the compensatory-use model rather than as evidence that one variable causes the other. Second, all measures were self-reported, which may introduce recall or social-desirability bias, particularly for sensitive items such as psychological distress and smartphone use; social desirability would most likely bias prevalence and association magnitudes downward if students under-report problematic use or distress. Third, the psychological distress screener was adapted from PHQ-4 wording, used here as a pragmatic four-item indicator, and showed low internal consistency ($\alpha = 0.34$) in this sample; it was not independently validated as a diagnostic tool, and its moderate correlation with the PSU score raises the possibility of shared method variance inflating the observed association. Fourth, three items of the SAS-SV were found to be near-exact duplicates of three other items, most plausibly reflecting a data-entry or questionnaire-construction error; we corrected for this by recomputing the score from the seven verified-unique items, but this correction could not restore any information that might have been present in the originally intended (and apparently never administered, or administered but not correctly logged) additional three items, and the resulting seven-item scale showed lower internal consistency ($\alpha = 0.44$) than is typically reported for the full SAS-SV likely attenuating associations toward the null relative to a more reliable instrument, even as residual shared-method variance with distress could inflate the distress coefficient. Fifth, the dataset used for final analysis did not retain an age variable despite age being part of the original sociodemographic questionnaire design, so age could not be examined or adjusted for; residual confounding by age (which likely correlates with academic year) cannot be excluded and may bias the senior-year AOR upward or downward depending on the age–PSU relationship in this population. Sixth, data were collected at a single public university using a convenience sampling approach within faculties, and the number of questionnaires distributed (response rate) was not logged, which limits generalizability to other institutions, private universities, or non-university young-adult populations in Bangladesh and prevents full STROBE item 13 reporting. Finally, the bivariate finding of comparatively high PSU prevalence among students reporting the shortest sitting time (< 3 hours/day) did not persist as a robust independent effect in the adjusted model and may reflect measurement imprecision in the self-reported sitting-time item rather than a genuine behavioural relationship; we report it descriptively but do not treat it as a substantive finding. The study was not pre-registered; analytic decisions such as ordinal coding and the sleep reference category were empirically informed and should be replicated in independent samples.

Implications

Despite these limitations, the pattern of associations especially the U-shaped sleep finding, the graded physical-activity association, and the distress correlation suggests coherent targets for campus health services: sleep-hygiene education that privileges a 7–8-hour window rather than “more sleep is always better,” structured opportunities for regular physical activity, and accessible counselling pathways for students with elevated distress, framed as support for compensatory-use pathways rather than as

punishment for “addiction.” Any such programmes should be evaluated with longitudinal or experimental designs and validated instruments before causal claims are advanced.

Conclusions

In this cross-sectional sample of 450 students at a Bangladeshi public university, over half (54.0%) met SAS-SV criteria for problematic smartphone use after correcting a data-entry duplication in the original scale administration. Male gender, senior academic standing, sleep duration outside the 7–8-hour range, greater sedentary time, lower physical activity frequency, and higher psychological distress were independently associated with higher odds of PSU in a diagnostically checked, parsimonious multivariable model. These findings suggest that university-level interventions targeting sleep regularity, physical activity promotion, and accessible mental-health support may be reasonable candidate strategies for addressing PSU in similar student populations, though the cross-sectional design means these associations should inform hypothesis generation rather than be treated as established causal targets. Future research should prioritize longitudinal or experimental designs, fully validated psychological instruments adapted and tested in Bengali-speaking student populations, multi-site probability sampling with logged response rates, and pre-registered analysis plans to establish the generalizability and directionality of the associations identified here.

Abbreviations

AOR
adjusted odds ratio
AUC
area under the receiver operating characteristic curve
CI
confidence interval
NSTU
Noakhali Science and Technology University
OR
odds ratio
PHQ-4
Patient Health Questionnaire-4
PSU
problematic smartphone use
SAS-SV
Smartphone Addiction Scale–Short Version
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology
VIF
variance inflation factor

Declarations

Ethics approval and consent to participate:

All procedures in this study complied with the ethical standards of the relevant national and institutional committees on human experimentation and with the Declaration of Helsinki (1975, revised 2013) [24]. The study protocol was approved by the Ethics Committee of Noakhali Science and Technology University (Reference no. NSTU/SCI/EC/2025/453, dated 15 January 2025). Written informed consent was obtained from all individual participants included in the study.

Consent for publication:

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Competing interests:

The authors declare no competing interests.

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Author Contribution

Conceptualization–M.A.M.R. and M.M.H.; methodology–M.A.M.R. and M.Z.M.; formal analysis–M.A.M.R. and S.H.; original draft preparation–N.I.M., S.H., M.I.I.R., and M.Z.M.; writing–M.A.M.R., S.H., M.M.H., and M.Z.M.; SPSS and testing–M.A.M.R. and N.I.M.; review and editing–N.I.M. and M.I.I.R. All authors have read and agreed to the published version of the manuscript.

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Data Availability

The dataset(s) and analysis scripts supporting the conclusions of this article are available from the corresponding author on reasonable request.

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