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Nonlinear Smartphone Use, Temporal Routines, and Nomophobia in a Digitalized University: A Secondary Analysis of Undergraduate Students

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Abstract

Nomophobia, the fear associated with being without one's smartphone, has emerged as a prevalent concern in increasingly digitalized university environments. This secondary analysis examined nomophobia and its correlates among 841 undergraduates at a public university using the 20-item Nomophobia Questionnaire. Confirmatory factor analysis supported the four-factor structure (information access, convenience, communication, connectedness) and high internal consistency. Multiple regression models showed that total nomophobia was higher among students in the higher gender category and older students, and was strongly associated with daily smartphone use in a nonlinear fashion, increases at higher use levels were linked with disproportionately elevated nomophobia scores. Faculty affiliation did not significantly predict nomophobia once demographics and usage patterns were controlled. Quartile profiles indicated that temporal routines, particularly early-morning checking, differentiated high-nomophobia students more clearly than total daily hours. Findings highlight nomophobia as a socio-technical outcome of campus-wide connectivity norms and underscore the need for university-level digital-well-being policies.

Introduction

Smartphones now mediate communication, learning, and administration in higher education (Livingstone et al., 2020; OECD, 2021). Alongside these benefits, "nomophobia" has emerged as a fear or discomfort associated with being without one's phone, linked to dependency-like smartphone use (King et al., 2010; Yildirim & Correia, 2015). It reflects anxieties about losing access to information, communication, convenience, and social connectedness (Yildirim & Correia, 2015). Understanding how nomophobia arises in digitalized universities is important for student mental health and the governance of educational technologies (OECD, 2021; Vanden Abeele, 2020).

The Nomophobia Questionnaire (NMP-Q) developed by Yildirim and Correia (2015) is the most widely used instrument to operationalize this construct, identifying four dimensions: not being able to communicate, losing connectedness, not being able to access information, and giving up convenience. Psychometric studies have generally supported this four-factor structure and reported excellent internal consistency in university samples across different countries (Bragazzi et al., 2019; Essel et al., 2021). However, most research has focused on total scores or subscales without systematically linking them to concrete usage patterns or institutional contexts (Nguyen et al., 2024; Samaha & Hawi, 2016). In digitalized universities, where smartphones support learning platforms, messaging groups, and administrative notifications, nomophobia may also reflect expectations to remain perpetually reachable (Livingstone et al., 2020; Vanden Abeele, 2020).

The relationship between smartphone use intensity and well-being is complex. While some studies report positive associations between the frequency or duration of smartphone use and nomophobia or problematic use (Elhai et al., 2017; Bragazzi et al., 2019), others find small or inconsistent links between total screen time and psychological outcomes (Orben & Przybylski, 2019; Johannes et al., 2024). Recent

large-scale analyses suggest that associations between digital engagement and well-being are often curvilinear: moderate use is not strongly harmful, whereas very high use is more reliably associated with distress (Przybylski & Weinstein, 2017; Orben, 2020). Moreover, temporal patterns such as checking phones first thing in the morning or late at night may be more strongly related to problematic engagement than sheer volume of use (Rozgonjuk et al., 2018; Meshi et al., 2015). Within higher education, these patterns intersect with institutional practices: push notifications from learning platforms, messaging groups for course coordination, and digital administrative systems can create a sense that being “offline” is risky or irresponsible (Livingstone et al., 2020; Vanden Abeele, 2020).

At the socio-demographic level, studies frequently report higher nomophobia and problematic smartphone use among female and older students, although effect sizes vary by context (King et al., 2014; Santos et al., 2016). These differences have been interpreted in terms of gendered expectations around social availability and emotional support, as well as the accumulation of role demands (e.g., combining study, work, and family responsibilities), which may increase reliance on smartphones as organizational and relational tools (Cho et al., 2025; Samaha & Hawi, 2016). Evidence on disciplinary differences is more mixed: some studies suggest that students in certain faculties report higher problematic use, whereas others find no robust faculty effects once general usage patterns and demographics are controlled (Bragazzi et al., 2019; Gezgin et al., 2018). Overall, the literature indicates that nomophobia arises at the intersection of individual factors, smartphone practices, and institutional digital cultures, but many studies remain focused on bivariate associations or linear models of screen time.

From the perspective of Technology in Society, nomophobia can be seen as a socio-technical outcome of how universities and platform providers structure digital communication and learning environments, not merely as an individual pathology (Livingstone et al., 2020; OECD, 2021). If academic communication, course management, and administrative procedures increasingly assume constant mobile connectivity, students may come to experience disconnection as risky for their academic and social standing, thereby intensifying nomophobia (Essel et al., 2021; Nguyen et al., 2024). Yet, policy and design discussions about educational technologies have often prioritized efficiency, access, and innovation over questions of digital dependence and psychological safety (OECD, 2021; Vanden Abeele, 2020). Identifying which usage patterns and socio-demographic groups are most strongly associated with nomophobia can inform choices about notification practices, communication norms, and digital-well-being initiatives in higher education (Livingstone et al., 2020; Johannes et al., 2024).

The present study contributes to this literature by conducting a secondary analysis of survey data from 841 undergraduate students at a public university, using the NMP-Q to assess nomophobia and examining its associations with gender, age, faculty, daily smartphone use, general checking frequency, and morning use. First, we confirm the four-factor structure and reliability of the NMP-Q in this context, adding evidence from a rapidly digitalizing higher-education setting (Yildirim & Correia, 2015; Essel et al., 2021). Second, we test whether the relationship between daily smartphone use and total nomophobia is nonlinear, in line with theories that emphasize threshold or saturation effects in digital-well-being

research (Przybylski & Weinstein, 2017; Orben, 2020). Third, we evaluate whether nomophobia varies across faculties once socio-demographic and usage variables are controlled, probing whether disciplinary context or campus-wide digital culture is more salient (Bragazzi et al., 2019; Gezgin et al., 2018). Finally, we describe smartphone-use profiles across nomophobia quartiles to highlight how temporal routines, particularly morning checking, may differentiate high-risk groups beyond total hours of use (Rozgonjuk et al., 2018; Meshi et al., 2015). By integrating psychometric validation with multivariate modeling and a focus on temporal and institutional factors, this study aims to inform both scholarly debates on digital well-being and practical discussions about designing healthier socio-technical ecosystems in higher education.

Methods

Study design and setting

Data were drawn from a publicly available dataset of 841 university students (18–29 years) from Kosovo, collected via paper-and-pencil surveys in Prishtina, Ferizaj, and Gjakova using stratified and purposive sampling (Basha & Mustafa, 2024).

This study used a cross-sectional survey design to examine nomophobia and its correlates among undergraduate students at a public university, consistent with prior work on smartphone-related problems in higher education (Bragazzi et al., 2019; Gezgin et al., 2018). The analysis used a secondary dataset originally collected as part of a broader study of smartphone use and psychological outcomes in a university context. Data were collected in regular class sessions using a paper-and-pencil questionnaire, a common mode of NMP-Q administration (Yildirim & Correia, 2015; King et al., 2014). At the time, smartphones were widely integrated into teaching, communication, and administrative processes, reflecting the digitalization of higher education (Livingstone et al., 2020; OECD, 2021).

Participants and procedure

Participants were 841 undergraduate students with complete data on demographics, smartphone use, and nomophobia. Students were recruited through classroom announcements made by instructors who briefly introduced the study and invited all present students to participate voluntarily. Those who agreed completed the questionnaire during class time and returned it in sealed envelopes, without providing names or student numbers, to preserve anonymity. No financial or course-credit incentives were offered, which is typical for minimal-risk survey research in educational settings (Bragazzi et al., 2019).

Inclusion criteria were: (a) current enrolment as an undergraduate student at the university, (b) ownership and regular use of a smartphone, and (c) sufficient proficiency in the survey language to understand and complete the questionnaire. Students who did not own a smartphone or returned questionnaires with extensive missing data on core variables (demographics, NMP-Q items, or key usage indicators) were excluded from the analytic sample. Ethical approval for the original survey was obtained

from the relevant institutional review board, and all procedures conformed to the principles of the Declaration of Helsinki regarding voluntary participation, confidentiality, and the right to withdraw without penalty (World Medical Association, 2013). For the present secondary analysis, data were used in de-identified form, and no recontact with participants occurred.

Measures

Demographics and academic characteristics

Students reported their gender, age, and faculty. Gender was coded using two categories, following the original dataset structure commonly adopted in survey-based studies of nomophobia and smartphone use (King et al., 2014; Bragazzi et al., 2019). Age was recorded in years as a continuous variable, which is standard practice in nomophobia research to enable fine-grained modeling of age gradients (Santos et al., 2016; Luo et al., 2021). Faculty indicated the broad academic unit in which students were enrolled; this was used as a proxy for differences in disciplinary context and digital demands, as done in prior work comparing nomophobia across fields of study (Gezgin et al., 2018).

Smartphone use indicators

Daily smartphone use was assessed with a single item asking students how many hours per day they typically used their smartphone, with responses recorded on a 5-category scale ranging from approximately 1–2 hours to 9–10 hours. Similar ordinal categories have been used in prior studies of nomophobia and smartphone addiction in university samples to capture overall intensity of use without requiring time-log data (Bragazzi et al., 2019; Elhai et al., 2017). General checking frequency was measured by asking how often students checked their smartphone during the day, with responses coded on a brief ordinal scale; such self-reported checking measures have shown meaningful associations with problematic use and nomophobia in earlier work (Van Deursen et al., 2015; Ellis et al., 2019).

Temporal use patterns were captured with an item asking whether students typically checked their smartphone in the morning immediately upon waking or later, coded on a two-category scale. Morning checking has been highlighted in the literature as a behavioral marker of more compulsive smartphone use and difficulties disengaging from devices (Rozgonjuk et al., 2018; Meshi et al., 2015). For regression analyses, the morning-use variable was coded so that lower values reflected more immediate checking upon waking, allowing interpretation of negative coefficients as indicating higher nomophobia among students who engage in earlier morning use.

Nomophobia

Nomophobia was assessed using the 20-item Nomophobia Questionnaire (NMP-Q), which was developed and validated by Yildirim and Correia (2015) and has been widely used in university samples

internationally. The NMP-Q captures four dimensions of nomophobia: not being able to access information, giving up convenience, not being able to communicate, and losing connectedness (Yildirim & Correia, 2015). Items are rated on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating greater nomophobia (Yildirim & Correia, 2015; King et al., 2014). In line with the original scoring procedure, a total nomophobia score (NoMoFobi) was computed by summing all 20 items, and four subscale scores were derived by summing the items corresponding to each dimension.

Previous studies have reported excellent internal consistency for the NMP-Q, with Cronbach's alpha typically above .90 for the total score and high reliability for subscales across different cultural contexts (Yildirim & Correia, 2015; Bragazzi et al., 2019). In the present sample, internal consistency for the total score and each dimension was assessed using Cronbach's alpha, and a confirmatory factor analysis (CFA) was conducted to verify the four-factor structure, following best practices for psychometric evaluation of adapted instruments (Kline, 2023; Brown, 2015). The CFA specified four correlated latent factors corresponding to the NMP-Q dimensions, with items constrained to load only on their intended factor; model fit was evaluated using standard indices such as the comparative fit index (CFI), Tucker-Lewis index (TLI), root-mean-square error of approximation (RMSEA), and standardized root-mean-square residual (SRMR), using recommended cutoffs as interpretive guidelines rather than rigid thresholds (Hu & Bentler, 1999; Kline, 2023).

Data analysis

All analyses were conducted in R version 4.5.2 (R Core Team, 2025) using RStudio on Windows. Data were imported from the original spreadsheet file and inspected for missing values, outliers, and coding inconsistencies. Descriptive statistics (means, standard deviations, and frequency distributions) were computed for all variables, and bivariate associations were examined using correlations and cross-tabulations to inform subsequent modeling decisions (Field, 2024). The CFA was estimated using the lavaan package, with robust estimators appropriate for ordered categorical data, and standardized factor loadings were extracted to summarize the measurement structure of the NMP-Q (Rosseel, 2012; Kline, 2023).

To address the primary research questions, a series of multiple linear regression models were fitted with total nomophobia (NoMoFobi) as the outcome. In the main model, predictors included gender, age, faculty, daily hours of smartphone use, general checking frequency, and morning use, reflecting demographic, contextual, and behavioral factors identified in prior nomophobia and smartphone-addiction research (Bragazzi et al., 2019; Elhai et al., 2017). To capture potential nonlinear associations between daily smartphone use and nomophobia, a quadratic term for daily hours (hours^2) was included after centering the hours variable, consistent with recommendations for modeling curvilinear relationships in psychological data (Aiken & West, 1991; Field, 2024). An additional model treated faculty as a factor to evaluate whether nomophobia differed across broad academic environments once other predictors were controlled (Gezgin et al., 2018).

Model assumptions were assessed by inspecting residual plots for linearity and homoscedasticity and by calculating variance inflation factors (VIFs) to evaluate multicollinearity, following standard regression diagnostics (Field, 2024). To examine the robustness of results to potential outliers and non-normal residuals, a sensitivity analysis was conducted using robust regression with Huber M-estimation, which down-weights observations with large residuals (Huber, 2025; Field, 2024). Coefficient patterns from robust models were compared with ordinary least squares estimates to evaluate the stability of key findings.

Finally, to provide an interpretable descriptive profile of smartphone use across different nomophobia levels, students were grouped into quartiles based on their total nomophobia scores, and group means were calculated for daily hours, checking frequency, and morning use. This quartile-based approach mirrors prior work that characterizes high- versus low-risk digital-use profiles in terms of both intensity and temporal patterns (Johannes et al., 2024; Vanden Abeele, 2020). All statistical tests were two-tailed with $\alpha = .05$, and 95% confidence intervals were reported where relevant (American Psychological Association, 2020; Vanden Abeele, 2020).

Results

All analyses were conducted on 841 undergraduate students with complete data on demographics, smartphone use, and nomophobia (Yildirim & Correia, 2015). The primary focus here is on (a) a nonlinear model of daily smartphone use, (b) a faculty-adjusted model, and (c) quartile-based profiles of nomophobia.

Nonlinear association between daily smartphone use and nomophobia

To examine whether daily smartphone use exhibited a nonlinear association with total nomophobia, we estimated a multiple linear regression including a centered hours term and its squared term, controlling for gender, age, faculty, general checking frequency, and morning use. This model accounted for approximately 31% of the variance in total nomophobia ($R^2 = .31$, adjusted $R^2 = .31$), improving on the earlier linear-only specification ($R^2 \approx .25$), which is comparable to other multivariate models linking problematic smartphone use with psychological outcomes in student samples (Elhai et al., 2017; Rozgonjuk et al., 2018).

Higher nomophobia scores were observed among students coded in the higher gender category ($b = 0.44$, $SE = 0.05$, $t = 7.99$, $p < .001$) and among older students ($b = 0.29$, $SE = 0.03$, $t = 8.86$, $p < .001$), consistent with evidence that women and older undergraduates often report greater nomophobia and smartphone-related anxiety than their counterparts (King et al., 2014; Santos et al., 2016). Faculty showed a marginal association ($b = 0.09$, $SE = 0.05$, $t = 1.66$, $p = .097$), whereas general checking frequency was not significantly related to total scores in this model ($b = 0.02$, $SE = 0.05$, $t = 0.33$, $p = .74$), echoing observations that raw checking counts may be less informative than broader usage patterns

and context (Van Deursen et al., 2015). Morning smartphone use remained a robust correlate: more intense morning engagement was associated with higher nomophobia (b = − 0.21, SE = 0.06, t = − 3.79, p < .001; coding such that lower values reflect more immediate morning use), which aligns with work linking early-day phone checking to heightened dependence and compulsive use (Meshi et al., 2015).

Crucially, both the linear (hours_c) and quadratic (hours_c2) terms for daily hours were strongly negative and statistically significant (hours_c: b = − 0.21, SE = 0.02, t = − 9.64, p < .001; hours_c2: b = − 0.14, SE = 0.02, t = − 8.55, p < .001), indicating a pronounced nonlinear relationship. In substantive terms, increases in daily smartphone use at the higher end of the distribution were associated with disproportionately elevated nomophobia scores, rather than a simple linear dose-response. This pattern is consistent with research suggesting that associations between screen time and well-being are often curvilinear, with risks intensifying at higher exposure levels rather than accumulating in a strictly linear fashion (Przybylski & Weinstein, 2017; Orben, 2020).

Table 1

Multiple regression of total nomophobia on nonlinear daily smartphone use and covariates (N = 841)

Predictor	b	SE	t	p
Intercept	1.33	0.14	9.25	< .001
Gender (higher category)	0.44	0.05	7.99	< .001
Age	0.29	0.03	8.86	< .001
Faculty	0.09	0.05	1.66	.097
Daily hours (centered)	−0.21	0.02	−9.64	< .001
Daily hours² (centered)	−0.14	0.02	−8.55	< .001
Checking frequency	0.02	0.05	0.33	.74
Morning use	−0.21	0.06	−3.79	< .001

Note. Daily hours are coded on a 1–5 ordinal scale; hours_c is mean-centered, and hours_c2 = hours_c².

Figure 2 depicts predicted nomophobia across the five hour categories, holding covariates at their means and stratified by gender, making visible the steeper rise at higher use levels and consistently higher scores in the higher gender category (Park et al., 2014; Cho et al., 2025).

Faculty-adjusted model of total nomophobia

To test whether differences across academic environments contributed to nomophobia beyond individual characteristics, we fitted a regression with faculty entered as a factor (Faculty_f) alongside gender, age, daily hours, checking frequency, and morning use. The overall model explained approximately 25% of the variance in total nomophobia (R^2 = .25, adjusted R^2 = .25), similar to other

cross-sectional nomophobia models in university samples that include demographic and behavioral predictors (Bragazzi et al., 2019; Gezgin et al., 2018).

The ANOVA for the faculty-adjusted model indicated that faculty membership did not significantly improve model fit beyond other predictors, $F(1, 834) = 1.86$, $p = .17$. In the coefficient output (Table 2), the contrast for the second faculty category (Faculty_f2) was small and non-significant ($b = 0.08$, $SE = 0.06$, $t = 1.49$, $p = .14$). By contrast, gender ($b = 0.49$, $SE = 0.06$, $t = 8.67$, $p < .001$) and age ($b = 0.31$, $SE = 0.03$, $t = 9.08$, $p < .001$) remained strong positive predictors of nomophobia, whereas higher daily hours ($b = -0.09$, $SE = 0.02$, $t = -5.24$, $p < .001$) and more immediate morning use ($b = -0.26$, $SE = 0.06$, $t = -4.39$, $p < .001$) were associated with higher scores after accounting for covariates. These results suggest that nomophobia in this setting is structured more by individual characteristics and everyday smartphone routines than by broad faculty affiliation, which is in line with studies reporting limited differences in problematic smartphone use across academic disciplines once gender and age are controlled (Samaha & Hawi, 2016; Elhai et al., 2017).

Table 2

Regression of total nomophobia on faculty and covariates (N = 841)

Predictor	b	SE	t	p
Intercept	1.40	0.15	9.18	< .001
Gender (higher category)	0.49	0.06	8.67	< .001
Age	0.31	0.03	9.08	< .001
Faculty_f2	0.08	0.06	1.49	.14
Daily hours (1–5)	−0.09	0.02	−5.24	< .001
Checking frequency	0.05	0.05	0.95	.34
Morning use	−0.26	0.06	−4.39	< .001

Note. Faculty_f is coded with the first faculty as the reference category.

Nomophobia quartiles and smartphone-use profiles

To provide an intuitive profile of smartphone use across different nomophobia levels, students were divided into quartiles of total nomophobia (NoMoFobi), and group means were computed for daily hours, general checking frequency, and morning use. Mean daily hours ranged from approximately 3.26 to 4.10 across quartiles, with no strictly monotonic gradient from lowest to highest nomophobia. The lowest quartile reported about 4.00 hours per day, whereas the highest quartile reported about 3.44 hours, suggesting that very high nomophobia is not simply a function of spending the most time on the smartphone. This pattern mirrors broader debates showing that simple screen-time metrics often fail to capture the complexity of digital well-being and that context, motives, and timing of use matter at least as much as total duration (Johannes et al., 2024; Orben, 2020).

General checking frequency averaged between 1.21 and 1.33 on the 1–2 response scale across quartiles, indicating that high- and low-nomophobia groups reported similarly frequent checking in general. In contrast, morning use showed a more distinct pattern; the highest-nomophobia quartile had the lowest mean morning score (≈ 1.11 vs. 1.32 in the lowest quartile), reflecting more immediate morning engagement under the coding used here. This pattern complements the regression findings by suggesting that temporal routines particularly early-day checking may be a more salient marker of nomophobia than aggregate hours or undifferentiated checking frequency, consistent with work linking "first thing in the morning" use to problematic engagement and difficulty disengaging from smartphones (Rozgonjuk et al., 2018; Meshi et al., 2015).

Table 3
Smartphone-use patterns by nomophobia quartile (N = 841)

Nomophobia quartile	Daily hours (1–5)	Checking frequency (1–2)	Morning use (1–2)
Lowest 25%	4.00	1.21	1.32
25–50%	4.10	1.23	1.29
50–75%	3.26	1.33	1.29
Highest 25%	3.44	1.30	1.11

Note. Values are group means based on cut points at the 25th, 50th, and 75th percentiles of NoMoFobi.

Taken together, these analyses indicate that nomophobia in this university sample reflects a combination of socio-demographic factors (gender, age), nonlinear patterns of daily smartphone use, and specific temporal routines (such as early-morning checking), rather than simple linear increases in screen time or crude faculty differences. This multidimensional pattern dovetails with contemporary views of digital well-being that emphasize the social embedding of smartphone use and the importance of "how" and "when" students are connected, not just "how long" they are online (Vanden Abeele, 2020; Johannes et al., 2024).

Discussion

This study examined how daily smartphone use, faculty context, and temporal routines relate to nomophobia among university students, extending work on smartphone-related distress in higher education (Bragazzi et al., 2019; Gezgin et al., 2018). The main findings were that (a) nomophobia showed a pronounced nonlinear association with daily smartphone use, (b) gender and age remained robust predictors even after adjusting for faculty affiliation, and (c) profiles of high versus low nomophobia differed more in temporal routines such as morning checking than in total hours or crude checking frequency.

The nonlinear association between daily hours and nomophobia dovetails with emerging evidence that the relationship between digital engagement and well-being is often curvilinear rather than strictly linear

(Przybylski & Weinstein, 2017; Orben, 2020). In the present data, both the linear and quadratic terms for daily hours were significant, indicating disproportionately elevated nomophobia scores at the higher end of the use spectrum. This accords with studies showing that moderate levels of digital use are not uniformly harmful and may even support social connection, whereas very high use is more consistently linked with anxiety, impaired control, and problematic smartphone use (Elhai et al., 2017; Rozgonjuk et al., 2018). From a technology-in-society perspective, these results suggest that university environments that normalize “always on” engagement may push some students past a threshold at which connectivity becomes experienced as compulsion rather than choice (Vanden Abeele, 2020).

The persistence of gender and age effects across models is consistent with prior studies reporting higher nomophobia and problematic smartphone use among female and older undergraduates (King et al., 2014; Santos et al., 2016). Gendered expectations around relational availability and emotional labor may contribute to stronger pressures on women to remain constantly reachable via mobile devices, thereby heightening anxiety about disconnection (Cho et al., 2025; Park et al., 2014). Likewise, older students may navigate more complex role demands, which could increase reliance on smartphones and amplify distress when access is threatened (Samaha & Hawi, 2016). In this sense, nomophobia may be understood not only as an individual vulnerability but also as an outcome of social roles and institutional arrangements that make continuous mobile connectivity a practical necessity (Vanden Abeele, 2020).

By contrast, faculty affiliation did not significantly predict nomophobia after controlling for gender, age, and usage-related variables, even though fields differ widely in how intensively they integrate digital tools into teaching and assessment (Bragazzi et al., 2019; Gezgin et al., 2018). One interpretation is that smartphones have become a generalized socio-technical infrastructure across faculties, blurring distinctions between more and less “digital” fields in everyday student experience (Van Deursen et al., 2015). Institutional practices such as using messaging apps for urgent announcements, online learning management systems for coursework, and digital platforms for administrative tasks may create similar connectivity expectations for students regardless of their discipline (Johannes et al., 2024). Under this scenario, nomophobia reflects a campus-wide digital culture rather than local faculty differences, pointing to the importance of university-level policies on communication norms, notification practices, and the design of digital learning environments.

The quartile-based profiles offer a complementary perspective: students in the highest nomophobia quartile were not the heaviest users in terms of daily hours, and general checking frequency differed only modestly across groups. This supports the argument that simple screen-time metrics are blunt indicators of digital risk and that contextual and temporal features of use matter at least as much as duration (Johannes et al., 2024; Orben, 2020). The more distinctive pattern was in morning use, where the highest-nomophobia group showed more immediate checking upon waking, in line with work linking “first-thing in the morning” and “last-thing at night” use with compulsive tendencies and difficulties disengaging from devices (Rozgonjuk et al., 2018; Meshi et al., 2015). Clinically and pedagogically, this points to temporal routines as promising intervention targets: helping students delay morning checking

or create “buffer zones” around waking and bedtime may be more effective than blanket recommendations to cut overall screen time (Vanden Abeele, 2020; Johannes et al., 2024).

These findings also speak to broader discussions about digital well-being and the governance of educational technologies. International bodies and policy reports increasingly emphasize that digital strategies in education should consider not only access and efficiency but also psychological well-being and autonomy (OECD, 2021; Livingstone et al., 2020). The present results suggest that design and policy choices that reduce unnecessary urgency such as batching non-critical notifications, clarifying response-time expectations, and avoiding last-minute digital announcements may mitigate the sense that students must remain perpetually available via smartphones. Similarly, universities could include guidance on healthy temporal routines for device use in orientation and digital-literacy programs, aligning institutional digitalization with principles of sustainable connectivity rather than maximal connectivity (Vanden Abeele, 2020; Elhai et al., 2017).

At the same time, several limitations must be acknowledged. The data are cross-sectional and based on a secondary analysis of an existing survey, which prevents causal inference, particularly regarding academic performance and mental-health outcomes (Bragazzi et al., 2019; Orben, 2020). All measures relied on self-report, including smartphone use, which can diverge from objective logs and misestimate actual behavior (Ellis et al., 2019; Johannes et al., 2024). The sample comprised undergraduates from a single national context, which may limit generalizability to other populations with different digital infrastructures and norms (King et al., 2014; Santos et al., 2016). Finally, the models did not include potentially important psychosocial variables such as depressive symptoms, academic stress, or adaptability, which have been shown to mediate or moderate associations between nomophobia and functioning (Gezgin et al., 2018; Luo et al., 2021).

Future research should build on these results in several ways. Longitudinal designs combining self-report and passive sensing could track how changes in temporal routines (e.g., reducing morning checking) influence nomophobia and well-being over time, providing stronger evidence for causal pathways (Ellis et al., 2019; Rozgonjuk et al., 2018). Studies that explicitly integrate institutional and platform-level variables such as course policies on device use, notification settings in learning management systems, and the use of group-chat apps for compulsory communication would help clarify how organizational decisions shape students’ sense of digital dependence (Vanden Abeele, 2020; Johannes et al., 2024). Interventions that adjust these socio-technical conditions, rather than focusing only on individual self-control, could be particularly informative for policy and practice. Additionally, linking nomophobia to objective academic performance, sleep metrics, and mental-health outcomes would provide a fuller picture of the educational and health consequences of smartphone-related distress (Elhai et al., 2017; Luo et al., 2021).

Conclusion

In summary, this study shows that nomophobia among university students is most strongly associated with gender, age, nonlinear patterns of daily smartphone use, and specific temporal routines such as early-morning checking, while broad faculty affiliation plays a comparatively minor role once these factors are considered. These results reinforce contemporary views that digital well-being in higher education is shaped by the interplay between individual characteristics and campus-wide socio-technical environments, rather than by raw screen-time totals alone (Vanden Abeele, 2020; Johannes et al., 2024). For universities and policy makers, the findings underscore the importance of designing digital communication and learning ecosystems that minimize unnecessary urgency and support healthier temporal rhythms of connectivity. For researchers, they highlight the value of moving beyond linear screen-time models toward frameworks that foreground thresholds, timing, and institutional context when conceptualizing and addressing nomophobia in a rapidly digitalizing world (Orben, 2020; Elhai et al., 2017).

Declarations

Competing interests

KNA declare that they have no conflict of interest.

Ethics approval

All procedures in the original study were in accordance with the ethical standards of the responsible institutional committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000.

Informed consent

In the original study, informed consent was obtained from all participants for inclusion and for research use of their anonymized data. The present secondary analysis used only de-identified public data and required no additional consent.

References

1. Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Sage Publications.
2. American Psychological Association. (2020). Publication manual of the American psychological association 2020. *American Psychological Association*.
3. Basha, E., & Mustafa, A. (2024). Dataset on the correlation between nomophobia dimensions among university students in Kosovo. *Data in Brief*, *55*, 110766. https://doi.org/10.1016/j.dib.2024.110766
4. Bragazzi, N. L., Re, T. S., & Zerbetto, R. (2019). The Relationship Between Nomophobia and Maladaptive Coping Styles in a Sample of Italian Young Adults: Insights and Implications From a Cross-Sectional Study. *JMIR Mental Health*, *6*(4), e13154. https://doi.org/10.2196/13154

5. Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford publications.
6. Cho, S., Lee, S., Woo, H. J., Ko, Y. H., & Jeong, K. H. (2025). Relationship between types of smartphone use among adolescents and smartphone addiction: focusing on gender differences. *Journal of Men's Health*, *21*(3), 33–43.
7. Elhai, J. D., Dvorak, R. D., Levine, J. C., & Hall, B. J. (2017). Problematic smartphone use: A conceptual overview and systematic review of relations with anxiety and depression psychopathology. *Journal of Affective Disorders*, *207*(207), 251–259. https://doi.org/10.1016/j.jad.2016.08.030
8. Ellis, D. A., Davidson, B. I., Shaw, H., & Geyer, K. (2019). Do smartphone usage scales predict behavior? *International Journal of Human-Computer Studies*, *130*(130), 86–92. https://doi.org/10.1016/j.ijhcs.2019.05.004
9. Essel, H. B., Vlachopoulos, D., & Tachie-Menson, A. (2021). The relationship between the nomophobic levels of higher education students in Ghana and academic achievement. *PLOS ONE*, *16*(6), e0252880. https://doi.org/10.1371/journal.pone.0252880
10. Field, A. (2024). *Discovering statistics using IBM SPSS statistics*. Sage publications limited.
11. Gezgin, D. M., Cakir, O., & Yildirim, S. (2018). The Relationship between Levels of Nomophobia Prevalence and Internet Addiction among High School Students: the factors influencing Nomophobia. *International Journal of Research in Education and Science*, *4*(1), 215–225. https://doi.org/10.21890/ijres.383153
12. Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, *6*(1), 1–55. https://doi.org/10.1080/10705519909540118
13. Huber, P. J. (2025). This Is Robust Statistics. *International Encyclopedia of Statistical Science, 2783–2786*. https://doi.org/10.1007/978-3-662-69359-9_723
14. Johannes, N., Masur, P. K., Vuorre, M., & Przybylski, A. K. (2024). How should we investigate variation in the relation between social media and well-being? *Meta-Psychology*, *8*. https://doi.org/10.15626/mp.2022.3322
15. King, A. L. S., Valença, A. M., & Nardi, A. E. (2010). Nomophobia: The Mobile Phone in Panic Disorder With Agoraphobia. *Cognitive and Behavioral Neurology*, *23*(1), 52–54. https://doi.org/10.1097/wnn.0b013e3181b7eabc
16. King, A. L. S., Valença, A. M., Silva, A. C., Sancassiani, F., Machado, S., & Nardi, A. E. (2014). "Nomophobia": Impact of Cell Phone Use Interfering with Symptoms and Emotions of Individuals with Panic Disorder Compared with a Control Group. *Clinical Practice & Epidemiology in Mental Health*, *10*(1), 28–35. https://doi.org/10.2174/1745017901410010028
17. Kline, R. B. (2023). *Principles and practice of structural equation modeling*. Guilford publications.
18. Livingstone, S., Stoilova, M., & Nandagiri, R. (2020). Data and Privacy Literacy. *The Handbook of Media Education Research*, 413–425. https://doi.org/10.1002/9781119166900.ch38

19. Luo, J., Ren, S., Li, Y., & Liu, T. (2021). The Effect of College Students' Adaptability on Nomophobia: Based on Lasso Regression. *Frontiers in Psychiatry*, 12. https://doi.org/10.3389/fpsyt.2021.641417
20. Meshi, D., Tamir, D. I., & Heekeren, H. R. (2015). The Emerging Neuroscience of Social Media. *Trends in Cognitive Sciences*, *19*(12), 771–782. https://doi.org/10.1016/j.tics.2015.09.004
21. Nguyen, T.-V., Ngoc Nguyen, Q.-A., Nguyen, N. P. H., & Nguyen, U. B. (2024). Smartphone use, nomophobia, and academic achievement in Vietnamese high school students. *Computers in Human Behavior Reports*, *14*, 100418. https://doi.org/10.1016/j.chbr.2024.100418
22. OECD. (2021). OECD Digital Education Outlook 2021. In *OECD Digital Education Outlook*. OECD. https://doi.org/10.1787/589b283f-en
23. Orben, A. (2020). Teenagers, screens and social media: a narrative review of reviews and key studies. *Social Psychiatry and Psychiatric Epidemiology*, *55*(4), 407–414.
24. Orben, A., & Przybylski, A. K. (2019). Screens, Teens, and Psychological Well-Being: Evidence from Three Time-Use-Diary Studies. *Psychological Science*, *30*(5), 682–696. https://doi.org/10.1177/0956797619830329
25. Park, N. (2014). Gender difference in social networking on smartphones: A case study of Korean college student smartphone users. *International Telecommunications Policy Review*, *21*(2), 1–18.
26. Przybylski, A. K., & Weinstein, N. (2017). A large-scale test of the goldilocks hypothesis: Quantifying the relations between digital-screen use and the mental well-being of adolescents. *Psychological Science*, *28*(2), 204–215. https://doi.org/10.1177/0956797616678438
27. R Core Team. (2025). *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing. https://www.r-project.org/
28. Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modeling. *Journal of Statistical Software*, *48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02
29. Rozgonjuk, D., Levine, J. C., Hall, B. J., & Elhai, J. D. (2018). The association between problematic smartphone use, depression and anxiety symptom severity, and objectively measured smartphone use over one week. *Computers in Human Behavior*, *87*, 10–17. https://doi.org/10.1016/j.chb.2018.05.019
30. Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. *Computers in Human Behavior*, *57*(1), 321–325. https://doi.org/10.1016/j.chb.2015.12.045
31. Santos, V. A., Freire, R., Zugliani, M., Cirillo, P., Santos, H. H., Nardi, A. E., & King, A. L. (2016). Treatment of Internet Addiction with Anxiety Disorders: Treatment Protocol and Preliminary Before-After Results Involving Pharmacotherapy and Modified Cognitive Behavioral Therapy. *JMIR Research Protocols*, *5*(1), e46. https://doi.org/10.2196/resprot.5278
32. van Deursen, A. J. A. M., Bolle, C. L., Hegner, S. M., & Kommers, P. A. M. (2015). Modeling habitual and addictive smartphone behavior. *Computers in Human Behavior*, *45*, 411–420. https://doi.org/10.1016/j.chb.2014.12.039

33. Vanden Abeele, M. M. P. (2020). Digital Wellbeing as a Dynamic Construct. *Communication Theory*, *31*(4). https://doi.org/10.1093/ct/qtaa024
34. World Medical Association. (2013). World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. *JAMA*, *310*(20), 2191–2194. https://doi.org/10.1001/jama.2013.281053
35. Yildirim, C., & Correia, A. P. (2015). Exploring the dimensions of nomophobia: Development and validation of a self-reported questionnaire. *Computers in Human Behavior*, *49*, 130–137. https://doi.org/10.1016/j.chb.2015.02.059

Figures

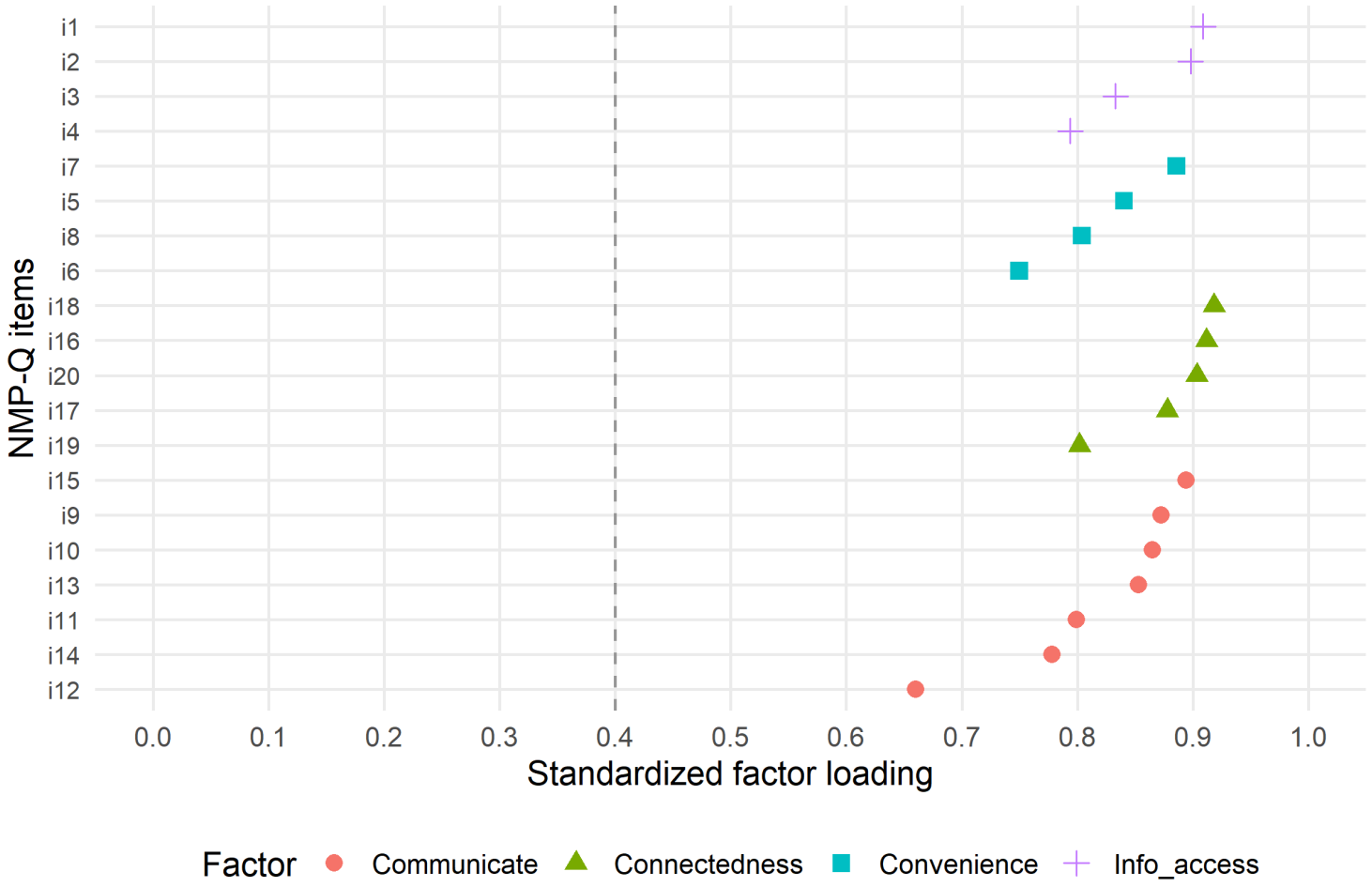


Figure 1

Standardized factor loadings for the four nomophobia dimensions (NMP-Q).

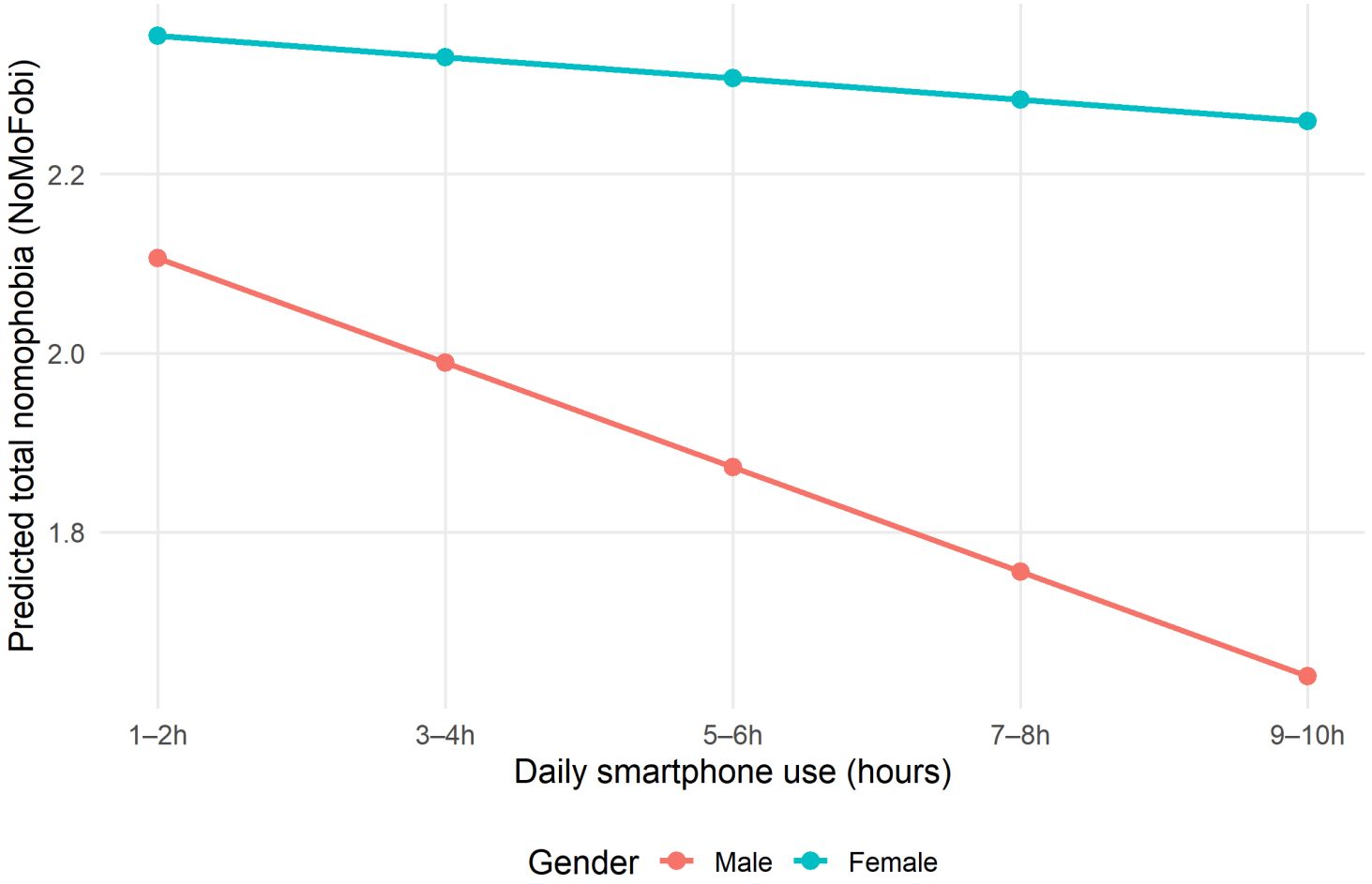


Figure 2

Predicted total nomophobia (NoMoFobi) across daily smartphone-use categories by gender.