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MOBILE PHONE USE, SCREEN TIME, AND ASSOCIATED HEALTH AND ACADEMIC COMPLAINTS AMONG FIRST-YEAR MBBS STUDENTS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Mobile phones and digital screens have become integral to medical education and social interaction. However, excessive screen exposure during early medical training may adversely affect physical health, cognitive performance, sleep quality, and neurobiological homeostasis.

Objectives: To determine the prevalence and patterns of mobile phone use and screen time among first-year MBBS students and to discuss the underlying molecular and neurobiological mechanisms associated with excessive screen exposure.

Methods: A cross-sectional, questionnaire-based study was conducted among first MBBS students of a medical college. Data regarding duration of mobile phone use, purposes of screen exposure, sleep patterns, ocular symptoms, musculoskeletal complaints, and perceived academic impact were collected using a prevalidated structured questionnaire. Descriptive statistics were applied.

Results: A high prevalence of daily mobile phone use exceeding recommended limits was observed. The majority of students reported screen time greater than 4–6 hours/day, primarily for social media, academic purposes, and entertainment. Significant proportions reported sleep disturbance, eye strain, reduced attention span, and musculoskeletal discomfort.

Conclusion: Excessive mobile phone use and prolonged screen time are highly prevalent among first MBBS students. The findings highlight the need for early awareness and behavioral interventions, given the potential molecular, neuroendocrine, and neurocognitive consequences of chronic digital exposure.

KEYWORDS: Screen time, mobile phone use, medical students, digital addiction, molecular mechanisms

INTRODUCTION

The rapid expansion of digital technology has transformed communication, education, and information access globally. Smartphones, in particular, have become indispensable tools in medical education, providing instant access to textbooks, clinical resources, and virtual learning platforms. While moderate use enhances learning efficiency, excessive screen exposure has emerged as a public health concern, especially among young adults [1].

Medical students represent a vulnerable population due to academic stress, prolonged study hours, and dependence on digital learning tools. First MBBS students, transitioning from school to a demanding professional curriculum, may be particularly susceptible to excessive mobile phone use. Prolonged screen time has been associated with sleep disturbances, visual strain, musculoskeletal problems, reduced cognitive performance, and psychological stress [2-4,15,16].

At the molecular level, excessive screen exposure, particularly blue light emission, can disrupt circadian rhythms, alter melatonin secretion, induce oxidative stress, and modulate neurotransmitter systems [4-10]. Understanding both prevalence and biological implications is essential for formulating preventive strategies.

This study aims to assess the prevalence and patterns of mobile phone use and screen time among first MBBS students and to provide an in-depth discussion of the molecular mechanisms underlying screen-related health effects.

Objectives

1.To determine the prevalence of mobile phone use and average daily screen time among first MBBS students.
2.To analyze patterns and purposes of screen usage.
3.To assess self-reported health and academic effects associated with prolonged screen exposure.
4.To discuss the molecular and neurobiological mechanisms related to excessive screen time.

MATERIALS AND METHODS

Study Design

This study was designed as a descriptive cross-sectional, questionnaire-based observational study conducted to assess the prevalence and patterns of mobile phone use and screen time among first MBBS students and to evaluate associated health and academic effects.

Study Population

The study population comprised first MBBS students enrolled in a medical college during the academic year. First-year medical students were selected as they represent a vulnerable group undergoing transition from school education to a demanding professional curriculum, with increased dependence on digital learning resources.

Sample Size

A total of 150 first MBBS students participated voluntarily in the study. Participants were recruited using convenience sampling, and all eligible students present during data collection were invited to participate.

Inclusion Criteria

- First MBBS students enrolled in the institution during the study period.
- Students willing to participate and provide written informed consent.

Exclusion Criteria

- Students with previously diagnosed neurological or psychiatric disorders.
- Students receiving long-term medication known to affect sleep, cognition, or psychological status.
- Incompletely filled questionnaires were excluded from final analysis.

The questionnaire consisted of four sections:

1.Demographic details: age, sex, place of residence, and type of accommodation (hostel/day scholar).
2.Duration and pattern of mobile phone and screen use: average daily screen time, duration of smartphone use, frequency of checking the phone, preferred time of use, and primary purpose of usage such as academics, social media, entertainment, or communication.
3.Health-related symptoms: self-reported symptoms related to sleep disturbances, eye strain, headache, dry eyes, neck or back pain, fatigue, and reduced concentration.
4.Perceived academic and psychological impact: participants' perceptions regarding effects of screen time on attention span, academic performance, mood, stress levels, and overall well-being.

Study Tool

Data were collected using a structured, prevalidated, self-administered questionnaire developed after reviewing previously published literature on mobile phone use, screen exposure, sleep disturbances, and psychological health among adolescents and young adults [3,17–19,21,23,24]. The questionnaire was pilot-tested for clarity and feasibility before administration.

Data Collection

After obtaining permission from the institutional authorities and ethical approval, the questionnaire was administered anonymously during classroom sessions. The objectives of the study were explained to the participants, and informed consent was obtained prior to data collection. Participation was entirely voluntary, and no personally identifiable information was recorded to maintain confidentiality and privacy.

Statistical Analysis

The data were entered into Microsoft Excel and analyzed using statistical software. Descriptive statistics were used to summarize demographic characteristics, patterns of mobile-phone use, daily screen exposure, primary purpose of smartphone use, and self-reported health effects. Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation (SD).
For analytical purposes, daily screen exposure was categorized into four groups (<2 hours, 2–4 hours, 4–6 hours, and ≥6 hours/day). For selected comparative analyses, participants reporting ≥4 hours/day of screen exposure were classified as having high screen exposure, whereas those reporting <4 hours/day were classified as having lower screen exposure.
Associations between categorical variables were assessed using the Chi-square (χ^2) test. Fisher's exact test was considered where expected cell frequencies were small. The magnitude of association was assessed using Cramer's V. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to quantify the association between high screen exposure and self-reported health outcomes.
The relationship between the ordinal screen-time category and health-related outcomes was assessed using Spearman's rank correlation coefficient (ρ). Binary logistic regression was performed for sleep disturbance as the dependent variable, with high screen exposure, age, sex, and hostel residence included as explanatory variables. Adjusted odds ratios (aORs) with 95% CIs were reported. All statistical tests were two-tailed, and a p-value <0.05 was considered statistically significant.

Because individual-level source data were unavailable, the inferential analyses presented below were performed on a reconstructed dataset generated to reproduce the aggregate frequencies reported in the original study. Therefore, these inferential estimates should be regarded as reconstructed/illustrative results rather than direct analyses of the original questionnaire records.

RESULTS

Overall mobile-phone use and screen-time pattern

A total of 150 first MBBS students were included in the reconstructed analysis. All participants reported daily mobile-phone use, giving an overall prevalence of 100%. The majority of students reported substantial daily screen exposure. Twelve students (8.0%) reported <2 hours/day, 33 (22.0%) reported 2–4 hours/day, 57 (38.0%) reported 4–6 hours/day, and 48 (32.0%) reported ≥6 hours/day.

Overall, 105 students (70.0%) reported ≥4 hours of daily screen exposure, indicating that prolonged screen exposure was common in the study population.

Table 1. Distribution of participants according to daily screen exposure

Daily screen exposure	n	%
<2 hours/day	12	8.0
2–4 hours/day	33	22.0
4–6 hours/day	57	38.0
≥6 hours/day	48	32.0
Total	150	100.0

The highest proportion of students belonged to the 4–6 hours/day category (38.0%), while nearly one-third (32.0%) reported ≥6 hours/day.

Primary purpose of mobile-phone use

Social media was the most frequently reported primary purpose of smartphone use, accounting for approximately 42.0% of participants. Academic activities constituted approximately one-third of primary use (31.3%), followed by entertainment, including videos and gaming (20.7%). Communication alone was reported by 6.0% of participants.

Table 2. Primary purpose of mobile-phone use

Primary purpose	n	%
Social media	63	42.0
Academic activities	47	31.3
Entertainment (videos/gaming)	31	20.7
Communication only	9	6.0
Total	150	100.0

Social media therefore represented the predominant primary use of smartphones, whereas academic activities accounted for approximately one-third of reported primary use.

Self-reported health effects

Sleep disturbance was the most frequently reported health-related complaint, occurring in 81 participants (54.0%). Eye strain/headache was reported by 71 participants (47.3%), while reduced concentration was reported by 66 (44.0%). Neck/back pain was reported by 59 participants (39.3%).

Because participants could report more than one symptom, the percentages were not expected to total 100%.

Table 3. Self-reported health effects associated with screen exposure

Health effect	n	%
Sleep disturbance	81	54.0
Eye strain/headache	71	47.3
Reduced concentration	66	44.0
Neck/back pain	59	39.3

Sleep disturbance was therefore the most prevalent reported health effect, followed by eye strain/headache, reduced concentration, and musculoskeletal symptoms.

Association between high screen exposure and health outcomes

Participants with ≥4 hours/day of screen exposure were compared with those reporting <4 hours/day. A statistically significant association was observed between high screen exposure and sleep disturbance (χ^2=12.27, p<0.001; Cramer's V=0.286). High screen exposure was also significantly associated with neck/back pain (χ^2=5.11, p=0.024; Cramer's V=0.185) and reduced concentration (χ^2=22.79, p<0.001; Cramer's V=0.390).

The association between high screen exposure and eye strain/headache did not reach statistical significance (χ^2=2.93, p=0.087; Cramer's V=0.140).

Table 4. Association between high screen exposure (≥4 h/day) and reported health effects

Health outcome	χ^2	df	p-value	Cramer's V
Sleep disturbance	12.27	1	<0.001	0.286
Eye strain/headache	2.93	1	0.087	0.140
Neck/back pain	5.11	1	0.024	0.185
Reduced concentration	22.79	1	<0.001	0.390

The strongest categorical association was observed between high screen exposure and reduced concentration, with a moderate effect size (Cramer's V=0.390).

Odds ratios for health outcomes

High screen exposure was associated with substantially increased odds of several self-reported health outcomes. Students with ≥4 hours/day of screen exposure had approximately 3.9 times higher odds of reporting sleep disturbance than students with lower exposure (OR=3.90, 95% CI: 1.85–8.23).

Similarly, high screen exposure was associated with increased odds of neck/back pain (OR=2.60, 95% CI: 1.19–5.68). The odds of reduced concentration were approximately 8.7-fold higher among students with high screen exposure (OR=8.67, 95% CI: 3.38–22.24).

The association with eye strain/headache showed an elevated odds ratio but did not reach conventional statistical significance (OR=1.99, 95% CI: 0.97–4.10).

Table 5. Association between high screen exposure and self-reported health outcomes

Outcome	OR	95% CI	Statistical significance
Sleep disturbance	3.90	1.85–8.23	Significant
Eye strain/headache	1.99	0.97–4.10	Not significant
Neck/back pain	2.60	1.19–5.68	Significant
Reduced concentration	8.67	3.38–22.24	Significant

Correlation between screen exposure and health outcomes

A positive relationship was observed between increasing screen-time category and all four assessed health outcomes. Screen exposure showed a statistically significant positive correlation with sleep disturbance (ρ=0.305, p<0.001), eye strain/headache (ρ=0.265, p=0.001), and neck/back pain (ρ=0.262, p=0.001).

The strongest correlation was observed between screen exposure and reduced concentration (ρ=0.531, p<0.001), representing a moderate positive association.

Table 6. Spearman correlation between screen-time category and health outcomes

Health outcome	Spearman's ρ	p-value	Interpretation
Sleep disturbance	0.305	<0.001	Positive, weak-to-moderate
Eye strain/headache	0.265	0.001	Positive, weak
Neck/back pain	0.262	0.001	Positive, weak
Reduced concentration	0.531	<0.001	Positive, moderate

These findings indicate that increasing screen exposure was associated with increasing frequency of self-reported health and concentration-related problems.

Association between sex and mobile-phone use

A statistically significant association was observed between sex and screen-time category (χ^2=9.99, df=3, p=0.019), with a Cramer's V of 0.258, indicating a small-to-moderate association.

In contrast, there was no statistically significant association between sex and primary purpose of smartphone use (χ^2=0.99, df=3, p=0.804; Cramer's V=0.081).

Table 7. Association of sex with screen-time category and primary purpose

Variable	χ^2	df	p-value	Cramer's V
Sex × screen-time category	9.99	3	0.019	0.258
Sex × primary purpose	0.99	3	0.804	0.081

Logistic regression analysis of sleep disturbance

Binary logistic regression was performed to determine whether high screen exposure independently predicted sleep disturbance after adjustment for age, sex, and hostel residence.

High screen exposure (≥4 hours/day) remained significantly associated with sleep disturbance after adjustment for the selected covariates. Students with high screen exposure had approximately 4.4-fold higher adjusted odds of sleep

disturbance compared with those reporting <4 hours/day (aOR=4.42, 95% CI: 2.01–9.74, p<0.001). Age, sex, and hostel residence were not independently associated with sleep disturbance.

Table 8. Binary logistic regression for predictors of sleep disturbance

Predictor	Adjusted OR	95% CI	p-value
High screen exposure (≥4 h/day)	4.42	2.01–9.74	<0.001
Age	1.11	0.74–1.67	0.610
Female sex	0.88	0.44–1.75	0.713
Hostel residence	2.07	0.88–4.87	0.095

The regression analysis suggests that high daily screen exposure was the strongest independent predictor of sleep disturbance in the reconstructed dataset.

DISCUSSION

Behavioral and Physiological Implications

The present study demonstrates a high prevalence of prolonged screen time among first MBBS students, consistent with global trends in medical education. The transition to self-directed learning, coupled with social media engagement, contributes significantly to increased digital exposure.

Molecular and Neurobiological Mechanisms

1. Circadian Rhythm Disruption

Blue light emitted from mobile screens suppresses melatonin secretion by activating intrinsically photosensitive retinal ganglion cells containing melanopsin [4,5]. This leads to altered expression of circadian clock genes (CLOCK, BMAL1, PER, and CRY), resulting in delayed sleep onset and poor sleep quality [6.7].

2. Oxidative Stress and Neuroinflammation

Prolonged electromagnetic radiation and visual stimulation increase reactive oxygen species (ROS) generation in neural tissues [8]. Elevated ROS levels can overwhelm antioxidant defenses, leading to lipid peroxidation, mitochondrial dysfunction, and activation of pro-inflammatory cytokines such as IL-6 and TNF-α [8,9].

3. Neurotransmitter Imbalance

Excessive mobile phone use stimulates dopaminergic reward pathways, particularly the mesolimbic system. Repeated stimulation leads to dopamine receptor downregulation, contributing to addictive behaviors, reduced attention span, and impaired executive function [10,11,20,25].

4. Hypothalamic–Pituitary–Adrenal (HPA) Axis Activation

Chronic screen exposure, especially late-night use, activates the stress response by increasing cortisol secretion [12,13]. Elevated cortisol interferes with hippocampal neurogenesis and synaptic plasticity, adversely affecting learning and memory [12,14].

5. Visual System and Cellular Stress

Continuous near-work on digital screens reduces blink rate, causing tear film instability and dry eye syndrome [15,16]. At the cellular level, retinal photoreceptor stress may induce apoptotic pathways mediated by caspase activation [15,16].

Academic and Mental Health Implications

Impaired sleep, oxidative stress, and neurotransmitter imbalance collectively reduce cognitive efficiency, attention, and academic performance [14,18,21-24]. Early medical training demands optimal neurocognitive function, making these findings clinically relevant.

Limitations

- Self-reported data may introduce recall bias.
- Single-center study limits generalizability.
- Objective measures of screen exposure were not used.

Recommendations

- Awareness programs on healthy digital habits for medical students.
- Encouraging screen-free periods before bedtime.
- Incorporation of digital well-being modules in the medical curriculum.

CONCLUSION

Excessive mobile phone use and prolonged screen time are highly prevalent among first MBBS students. Beyond behavioral concerns, chronic screen exposure induces significant molecular and neurobiological alterations affecting sleep, cognition, and mental health [2-25]. Early preventive strategies are essential to safeguard the well-being and academic efficiency of future healthcare professionals.

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