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SMARTPHONE ADDICTION AND ANXIETY AMONG MEDICAL STUDENTS: A CROSS-SECTIONAL STUDY IN KERALA

Dr Sreelal T P[1*], Mr. Adwaith Nair[2], Dr Abhinand Sai MB[3], Mr. Advaith Murali[4], Ms. Adithya Vijay[5], Ms. Adya Sasidharan[6], Ms. Agnes Mariya Sabu[7]

[1*]Associate Professor, Department of Community Medicine, Dr Moopen's Medical College, Wayanad, India, tpsreelal@gmail.com
[2] Final year MBBS Student, Dr Moopen's Medical College, Wayanad, India, adnair12@gmail.com
[3]Assistant Professor, Department of Community Medicine, Dr Moopen's Medical College, Wayanad, India, abhinandsai@gmail.com
[4]Final year MBBS Student, Dr Moopen's Medical College, Wayanad, India, advaithmurali7777@gmail.com
[5]Final year MBBS Student, Dr Moopen's Medical College, Wayanad, India, adithyvijay693@gmail.com
[6]Final year MBBS Student, Dr Moopen's Medical College, Wayanad, India, advasnair@gmail.com
[7]Final year MBBS Student, Dr Moopen's Medical College, Wayanad, India, agnesmariya2505@gmail.com

***Corresponding author:** Dr Sreelal T P
*Associate Professor, Department of Community Medicine, Dr Moopen's Medical College, Wayanad, India– 673577, Phone: +91 9918209175, email: tpsreelal@gmail.com

Abstract
With increasing availability of smartphones in our society, there is an increasing concern about its excessive use and addiction. Problematic smartphone use can have a negative impact on mental health and excessive use can lead to poor academic performance. This study aims to estimate the prevalence of smartphone addiction (SPA) and its association with anxiety among medical students in Kerala. A cross-sectional study was done among 261 medical students of Kerala using an online questionnaire in the google form. Problematic smartphone use (PSU) was assessed using Smartphone Addiction Scale – Short Version (SAS-SV). The presence of anxiety was assessed using a screening tool, Generalised Anxiety Disorder - 7 (GAD-7). The prevalence of smartphone addiction was estimated, and its association with the anxiety was assessed. The study shows that problematic smartphone usage is present in 110 (42%) of the participants studied and anxiety in 40 (15%) participants. The comparative analysis reveals that there is a significant association between smartphone addiction and anxiety, with an Adjusted Odds Ratio (AOR) of 3.69 (95% CI: 1.70 - 7.98), p-value <0.001. The study identifies the significant association between smartphone addiction and anxiety. In the digital era, PSU and mental health is considered a major public health concern needing targeted intervention. Future studies should be done focusing on the long-term effect of smartphone addiction, its effect on the mental health and the effectiveness of interventions.

Keywords: Smartphone addiction, anxiety, medical students, mental health, Kerala

1. Introduction

Over the past decade, use of smartphones have changed the way people communicate, access information, and carryout their daily routines. The increasing dependence on smartphone has increased, raising concerns about the ill effects due to overuse of smartphones, especially among young adults. Even though smartphones are convenient and widely used, excessive use has been linked to various of behavioural and psychological problems (1). Medical students are one of the most susceptible groups due to the intense academic pressures, high expectations, and limited opportunities for relaxation. These factors may increase their risk for developing mental health issues such as anxiety and depression. The integration of smartphones into almost every aspect of their lives has also contributed to the complexity of the issue, with concerns over the potential addiction to smartphones as well as on the mental health of the students.

Smartphone addiction (SPA) refers to the compulsive and uncontrollable use of smartphones that interferes with normal daily activities, including academic performance, relationships, and emotional well-being. Several studies have shown that SPA is associated with adverse outcomes like anxiety, depression, sleep disturbance, and poor academic performance. Individuals with smartphone addiction may show withdrawal symptoms like irritability, restlessness, or anxiety upon deprivation of the smartphone. Excessive checking of notifications when not required and the fear of missing out (FOMO) are characteristic behavioural patterns seen in such cases (2,3). In a meta-analysis, smartphone addiction was found to be associated with anxiety, depression, impulsivity, and sleep, particularly among college students (4). As a student group, medical students are more at risk due to their very stressful academic environment and lifestyle problems. The objective of the study is to estimate the prevalence of smartphone addiction and its association with anxiety among medical students in Kerala, a southern state in India. The study also contributes to understanding smartphone addiction as a growing public health concern and provides evidence that can guide interventions to promote healthier digital habits and emotional resilience among future doctors.

2. Methods

A cross-sectional study was conducted among undergraduate medical students studying MBBS course in medical colleges in Kerala, a southern state of India. The data collection period was four months, from June 2024 to September 2024. Students who had a previous history of mental illness or chronic health disorders known to have a substantial influence on mental health status were excluded to avoid possible confounding. The total sample size of the study was 261, and a non-probability convenience sampling was used to select the study participants. The present study aimed to collect data through self-administered online questionnaires, which has become an established method of behavior and mental health research (5). The questionnaire in Google form was administered to undergraduate medical students from several medical colleges in Kerala. Informed consent was taken from the respondents before taking part in the research.

The questionnaire had three major parts: i) Problematic smartphone use (PSU) in patients using the smartphone was assessed using the *Smartphone Addiction Scale – Short Version (SAS-SV)*. The SAS-SV is composed of 10 items rated on a 6-point Likert scale, ranging from 1 (strongly disagree) to 6 (strongly agree). A higher overall score means a higher level of smartphone addiction. ii) The *GAD-7* is a validated screening instrument that measures generalized anxiety disorder and panic disorder, social anxiety disorder, and post-traumatic stress disorder. The 7 items are scored on a 4-point scale from 0 (“not at all”) to 3 (“nearly every day”), and the total score ranges from 0 to 21. iii) The last section collected extensive information on smartphone usage and behavioral patterns. It consisted of both multiple choice and short-answer items. All responses were obtained electronically and pre-processed for analysis. A multi-tool approach in this regard allows for a comprehensive assessment of smartphone addiction levels as well as associated anxiety problems among medical students.

Data Analysis: Data were initially compiled and arranged in Microsoft Excel, then statistically analyzed using Jamovi software version 2.6.45.0. The quantitative variables (age, hours of use of smartphones per day, SAS-SV and GAD-7 scores) were summarized using means and standard deviation or median and interquartile range. Qualitative variables, including gender, academic year,

or smartphone addiction or anxiety, were represented as frequency and proportion. Chi-square test was used to examine associations between smartphone addiction and anxiety in the participants. Student t-test was performed to test the equivalency and difference of a quantitative variable between two age groups (e.g., duration and frequency of smartphone use). For all analyses, p-value < 0.05 was considered to be statistically significant.

Ethical considerations: The study commenced only after obtaining the Institutional Ethical Committee approval. Informed consent was obtained from all the participants before the data collection. Participant privacy and confidentiality of the data being collected were confirmed, and all responses were subsequently anonymized to ensure their identity. The research adhered to the ethical principles of the Declaration of Helsinki.

3. Results

A total of 261 undergraduate medical students from various medical colleges in Kerala participated in this study

Demographic Characteristics

The age of the study participants ranged from 18 to 27 years and the mean age was 21.65 ± 1.33 years. Overall, 147 (56%) belonged to the age group of 22 years or older, while 114 (44%) students were 21 years of age or less. In terms of gender, the study had a higher representation of females, with 193 (74%) participants, compared to males, with 68 (26%) participants. Students from all years of the MBBS course took part in the study. The highest number of participants 137 (52%) were from the final and 3rd years, and 124 (48%) participants were from the first and 2nd years (Table 1).

Table 1: General characteristics of the study participants and the smartphone usage pattern (N=261)

Variable name	Categories	Frequency (n)	Percentage (%)
A. Characteristics of the study participants			
1. Age group	Age Group ≤21 yrs	114	44
	Age Group ≥22 yrs	147	56
2. Gender	Male	68	26
	Female	193	74
3. Year of study	1st Year	16	6
	2nd Year	108	41
	3rd Year	119	46
	Final Year	18	7
B. Smartphone Usage Patterns			
1. Daily use (hrs/day)	Average use >4 hrs/day	177	68
	Average use ≤4 hrs/day	84	32
2. Frequency of checking the phone	High (every 5-10 mins)	81	31
	Low (every 20-30 mins)	180	69
3. Main use	Social Media & Entertainment	238	91
	Academic & Others	23	9
4. Time of smartphone use	Night-time use	222	85
	Day-time use	39	15

Smartphone Use Patterns

The mean duration of daily smartphone usage among participants was 5.52 ± 2.28 hours, with a reported usage range from 1 to 15 hours per day. Overall, 177 (68%) participants reported using their smartphones for more than 4 hours per day, while 84 (32%) of them used it for 4 hours or less per day. The mean frequency of checking smartphones by the study participants was 20.11 ± 9.00 times per hour. A combined analysis indicated that 81 (31%) participants engaged in high-frequency checking (every 5–10 minutes), while 180 (69%) participants had low-frequency checking (every 20–30 minutes) (Table 1).

The main purpose for which participants used smartphone use was to check social media, 123 (47%), and entertainment, 115 (44%), while academic and other uses combined together constituted 23 (9%) participants. Smartphone use was found to be most common at night time, amounting to 222 (85%) participants, while daytime usage accounted for 39 (15%) participants (Table 1).

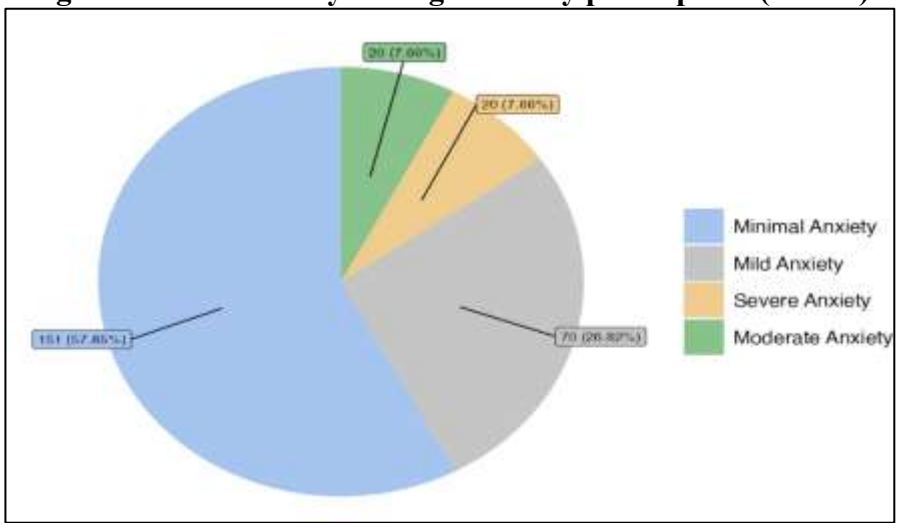
Prevalence of smartphone addiction and anxiety

The smartphone addiction among medical students was assessed using the Smartphone Addiction Scale - Short Version (SAS-SV). Problematic smartphone usage (PSU) was identified in 110 (42%) participants out of the 261 participants. Anxiety, measured using the GAD-7 scale, was present among 40 (15%) participants, while 221 (85%) participants reported no anxiety (Table 2). According to the severity classification, 20 (8%) participants had severe anxiety (Fig 1).

Table 2: Presence of problematic smartphone usage and anxiety among the study participants (N=261)

Variable name	Categories	Frequency (n)	Percentage (%)
Problematic Smartphone Usage (PSU)	PSU (Yes)	110	42
	PSU (No)	151	58
Presence of Anxiety	Anxiety Present	40	15
	Anxiety Absent	221	85

Fig 1: Levels of anxiety among the study participants (N=261)



Factors associated with problematic smartphone usage.

Logistic regression analysis was done to assess the association between problematic smartphone usage and various factors. It showed that demographic factors such as age, gender, and year of study were not related to PSU. However, daily smartphone use >4 hours was the strongest independent predictor of PSU, with an adjusted odds ratio of 2.78 (95% CI: 1.46–5.29; p = 0.002). High-frequency smartphone checking also revealed a significant association in unadjusted analysis (crude OR: 2.21; p = 0.003), but the association was attenuated after adjustment (adjusted OR: 1.39; p = 0.28), indicating that long hours of daily use, rather than the frequency of checking per se, constitutes the main behavioral risk factor for developing problematic smartphone use patterns (Table 3). The main purpose for which students used smartphones-entertainment & social media versus academics-was not statistically significant, with a crude OR of 2.20 and a p-value of 0.10. Of importance, anxiety symptoms were highly associated with PSU, with a crude OR of 3.96 (95% CI 1.91–8.20, p< 0.001), and further analysis showed an adjusted OR of 3.69 (95% CI 1.70–7.98, p< 0.001).

Table 3: Association between Problematic Smartphone Usage (PSU) and various factors. (N=261)

Variables		Problematic Smart Usage		Crude OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Names	Category	PSU	No PSU				
1. Age	>= 22 yrs	69 (63)	78 (52)	1.58 (0.95,2.60)	0.07	1.00 (0.53, 1.90)	0.99
	<=21 yrs	41 (37)	73 (48)				
2. Gender	Male	33 (30)	35 (23)	1.42 (0.81, 2.48)	0.22	1.00 (0.53, 1.90)	0.28
	Female	77 (70)	116 (77)				
3. Year of study	Final & 3rd year	68 (62)	69 (46)	1.92 (1.17, 3.17)	0.10	1.47 (0.78, 2.77)	0.24
	First & 2nd year	42 (38)	82 (54)				
4. Daily usage (hours/day)	>4 yrs	90 (82)	87 (58)	3.31 (1.85, 5.93)	<0.001	2.78 (1.46, 5.29)	0.002
	Upto 4 hrs	20 (20)	64 (42)				
5. Frequency of checking smartphone	High	45 (41)	36 (24)	2.21 (1.30, 3.77)	0.003	1.39 (0.77, 2.51)	0.28
	Low	65 (59)	115 (76)				
6. Main use of smartphones	Entertainment & Social media	104 (95)	134 (89)	2.20 (0.84, 5.77)	0.10	2.26 (0.79, 6.49)	0.13
	Academics and others	6 (5)	17 (11)				
7. Time of use	Night time	95 (86)	127 (84)	1.20 (0.60, 2.40)	0.61	—	—
	Day time	15 (14)	24 (16)				
8. Presence of Anxiety	Present	28 (25)	12 (8)	3.96 (1.91, 8.20)	<0.001	3.69 (1.70, 7.98)	<0.001
	Absent	82 (75)	139 (92)				

Discussion

The prevalence of smartphone addiction among medical students in Kerala was found to be high,

with 46.0% (95% CI: 39.96–52.04%) exhibiting PSU. This finding suggests academic pressure of greater levels in study of medicine in the academic environment, while long study hours and academic workload increase users' dependence on smartphones as a means of coping strategy. Medical students deal with great pressure to perform academically and clinical responsibility, which has been noted to increase high levels of stress and burnout as the main outcome (6). First, smartphones provide direct access to educational and social information. On the other side, though, they can also be an enormous source of distraction and compulsion. The vast majority of students utilize social media, games and instant messaging as coping strategies for stress relief, supporting the addiction. This aligns with a previous studies suggesting that heavy smartphone use among university students is related to a need for continuous access and the fear of missing out FOMO (7).

This study shows a significant relationship between smartphone addiction and anxiety, $\chi^2 = 28.817$, $p < 0.001$. Out of the students with severe anxiety, PSU was present in 85.0%. Excessive use of smartphones might result in disrupted sleep, while poor quality sleep is related to worsening anxiety (8). Additionally, frequent notifications and social comparison on digital platforms can further increase stress and feeling of isolation (9). Conversely—students suffering from anxious behaviors can in turn compulsively access smartphones as a coping strategy, leading to further increase in anxiety that aggravates mental health disorder and addiction (10). Similar relationship was observed in other studies of technology overuse and poor mental health (11). There was no significant associations between smartphone addiction and demographic factors like age ($p = 0.64$), gender ($p = 0.13$), or academic year ($p = 0.16$), indicating that PSU is a prevalent problem among the medical students with no significant demographic variation. Academic year was found to be significantly associated with anxiety, with a maximum prevalence of severe anxiety among third-year students, 70.0% ($p = 0.031$). This might be due to the higher workload and transformation to clinical roles that accompany this stage of study (12).

Comparison with Previous Studies

The prevalence of smartphone addiction, as estimated by this study, is 46.0%, which is higher than some of the previous studies. A study from Maharashtra, India among MBBS students using SAS-SV tool reported a prevalence of 26.9% (13). Such variation may occur due to different academic environment or timing, as smartphone use has been markedly increasing over the past couple of years. The prevalence of problematic smartphone use has indeed varied among university students with increased digital engagement during the COVID-19 pandemic, where changes in smartphone use patterns and addiction levels were reported in many studies (14–16). This strong association between smartphone addiction and anxiety is consistent with the findings of previous studies. Some studies have found that there is a strong association of excessive smartphone use with higher anxiety levels and poor sleep quality among university students (8). A meta-analysis has also confirmed the positive correlation of mobile phone addiction with anxiety, in on-campus college settings (10). On the other hand, few studies also found weaker associations owing to the differences in study design, population, or instruments of anxiety assessment methodology(1). Methodologically we used established instruments such as SAS-SV and GAD-7, as was appropriate for context, aligned with best practice in our context as observed through similar study (17). Nevertheless, our study targeted medical students from the state of Kerala and hence offered a more detailed view of how academic stress affects the smartphone usage compared to more multicultural samples of previous studies.

Strengths and Limitations

This study utilized validated tools, SAS-SV and GAD-7, for reliable assessment of smartphone addiction and anxiety. After initial prevalence estimates, the sample size of 261 was enough to establish sufficient statistical power. By focusing on a defined population, medical students, this study adds important contextual knowledge with regard to electronic patterns of behavior in a high-stress academic setting. However, there are several limitations to be acknowledged. As the study design is cross-sectional, causal inference cannot be made; moreover, it is not yet clear if anxiety is a cause or

an effect of smartphone addiction. Self-reported data obtained via online questionnaires may be associated with recall or social desirability bias. Moreover, the convenience sampling limits the generalizability of findings to all medical students in Kerala State.

Implications for Practice and Research

The study findings highlights the urgent need for institutional level measures to promote healthy smartphone use among medical students. Universities and medical colleges should organize awareness programs to educate the students about responsible digital use, and psychological dangers of excessive usage. Digital wellness initiatives, such as monitoring screen time, scheduling breaks or "digital detox," could make students less dependent. Colleges should promote the use of more student support services, such as counseling and stress management workshops, especially for third year students, who appear to be most vulnerable to anxiety. Longitudinal studies are needed to investigate the directionality of the smartphone addiction-anxiety relationship. Intervention-driven studies examining various types of mindfulness programs, digital detox work, or cognitive-behavioral therapies will clarify if these programs can help reduce not only smartphone use but also anxiety. These researches would provide a foundation for evidence-based public health policies to address the overuse of smartphones among youths.

5. Conclusion

The present study revealed a significantly higher prevalence of smartphone addiction among medical students of Kerala. Moreover, addiction to smartphones is strongly associated with anxiety. This underlines the negative consequence of excessive smartphone use on mental well-being, especially in the demanding atmosphere of medical education. There seem to be no demographic differences, indicating a generalized state of smartphone addiction among the students, whereas middle-year students appear to be more impacted by anxiety. Medical colleges have an urgent need to promote healthier digital behavior via awareness programs, digital detox programs, stress management workshops etc. It is also suggested that counselling services and peer support systems to help deal with anxiety and overuse of smartphones need to be strengthened, too. Further longitudinal research on causality and intervention effectiveness will be needed to examine whether future generations of medical staff are able to preserve both academic performance and mental resiliency in an ever-more digital world.

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