

Original Research Article

Smart phone addiction and reading comprehension among medical undergraduates: a cross-sectional study

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Received: 28 July 2026

Accepted: 03 August 2026

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ABSTRACT

Background: The demanding nature of medical education requires continuous access to updated information, online learning platforms, and e-books. Smartphone have therefore become indispensable educational tools, enabling students to access learning resources anytime and anywhere. The widespread adoption of digital learning, further accelerated by the COVID-19 pandemic, has strengthened the dependence of medical students on smartphone for both academic and non-academic purposes.

Methods: All phases of students of Bachelor of Medicine and Bachelor of Surgery (MBBS) course were enrolled and a total of 504 students participated in study. Data was collected through Google form survey on sociodemographic details, smartphone addiction scale-short version and reading comprehension questionnaires.

Results: Our study show 46% (232) prevalence of smartphone addiction among 504 participants, more common in male 27.8% in comparison to female students 18.3%. Majority reported 3-4 hours per day use of smartphone primarily to access social media. Similarly, they continue to use smartphone before sleep and majority for more than 30 minutes to 1 hour was reported significant predictor to smartphone addiction. Craving for phone during routine activities and feeling uncomfortable without phone were significant predictors to addiction of smartphone. The correlation $r=0.405$ ($p=0.00$) seen between smartphone addiction and reading comprehension show weak positive association ($r^2=0.164$).

Conclusions: Due to alarming use of smartphone, its addiction has become a public health concern of community. The study reported a statistically significant positive correlation between reading comprehension and smartphone addiction explaining the profound influence of smartphone usage on academic performance. Hence, there is to bring out various intervention strategies in the community and educational settings through awareness programmes, campaigns, to develop appropriate technology to assess reading comprehension among students.

Keywords: Smartphone addiction, Medical students, Reading comprehension

INTRODUCTION

The rapid advancement of digital technology has transformed almost every aspect of modern life; with Smartphone becoming one of the most widely used technological devices across the globe.¹ Initially developed as communication tools, smartphone have evolved into multifunctional devices that facilitate internet access, social networking, entertainment, banking, navigation, and education. Their portability, affordability, and easy accessibility have resulted in an unprecedented rise in

smartphone ownership, particularly among adolescents and young adults.² India, one of the world's largest smartphone markets, has witnessed a remarkable increase in smartphone penetration over the past decade; making these devices an integral part of students' daily lives.³

Among university students, medical undergraduates constitute a unique group of smartphone users. The demanding nature of medical education requires continuous access to updated information, online learning platforms, e-books, medical applications, clinical

guidelines, and scientific literature. Smartphone have therefore become indispensable educational tools, enabling students to access learning resources anytime and anywhere. The widespread adoption of digital learning, further accelerated by the COVID-19 pandemic, has strengthened the dependence of medical students on Smartphone for both academic and non-academic purposes.^{1,4,5}

Despite their undeniable educational benefits, concerns have emerged regarding excessive and uncontrolled smartphone use. In recent years, problematic smartphone use, commonly referred to as smartphone addiction, has gained increasing attention as an important behavioural health issue.⁶ Smartphone addiction is characterized by compulsive and excessive use despite awareness of its harmful consequences, accompanied by impaired self-control, withdrawal symptoms, tolerance, and interference with academic performance, interpersonal relationships, and everyday functioning.^{7,8} Although it is not formally classified as a substance use disorder, its behavioural characteristics closely resemble other forms of technological addiction. Growing evidence suggests that excessive smartphone use is associated with anxiety, depression, sleep disturbances, reduced physical activity, impaired concentration, stress, and diminished academic performance.⁶

Medical education is intellectually demanding and requires sustained attention, critical thinking, effective memory, and strong reading skills.⁵ Reading comprehension, defined as the ability to understand, interpret, analyze, and retain written information, is fundamental to successful medical training.⁹ Throughout the undergraduate curriculum, students are expected to read and comprehend extensive volumes of textbooks, research articles, clinical guidelines, and evidence-based literature. Effective reading comprehension not only facilitates knowledge acquisition but also supports clinical reasoning, problem-solving, and evidence-based decision-making, all of which are essential competencies for future physicians.^{5,9}

However, the increasing dependence on Smartphone has raised concerns regarding their potential impact on students' cognitive performance. Constant notifications, frequent interruptions, multitasking between educational and social media applications, prolonged screen exposure, and the habit of rapidly switching attention may reduce the ability to engage in deep, focused reading. Instead of carefully processing information, students may adopt superficial reading patterns characterized by skimming and fragmented attention, which can adversely affect comprehension, critical analysis, and long-term retention of knowledge.⁹ Moreover, excessive screen time has been linked to visual fatigue; poor sleep quality, mental exhaustion, and reduced executive functioning, all of which may indirectly compromise learning efficiency.⁹⁻¹¹

A growing body of international literature has documented the high prevalence of smartphone addiction among

university students. Depending on the study population and assessment instrument used, reported prevalence ranges from approximately 20% to 50%.^{12,13} Similar findings have been reported in India, where studies among medical students have demonstrated smartphone addiction rates ranging from 30% to 60%.^{14,15} Previous research has consistently shown significant associations between problematic smartphone use and poor academic performance, reduced attention span, psychological distress, sleep disorders, and decreased overall well-being.^{12,13} Nevertheless, relatively few studies have specifically explored the relationship between smartphone addiction and reading comprehension, particularly among undergraduate medical students in India.

This issue deserves particular attention because medical students differ from many other university populations in terms of their academic workload and reading demands. While Smartphone undoubtedly enhance access to educational resources and promote flexible learning, excessive dependence on these devices may unintentionally interfere with essential cognitive processes required for effective learning. Achieving an appropriate balance between the educational benefits of smartphone technology and its potential adverse effects remains an important challenge for medical educators and students alike.^{6,9}

Furthermore, there is limited evidence from the Indian context examining how smartphone addiction influences reading comprehension among undergraduate medical students. Most existing studies have primarily focused on academic performance, sleep quality, mental health, internet addiction, or psychological well-being, with comparatively little attention given to reading comprehension as an independent educational outcome.^{6,12,13,16,17} Considering the increasing integration of Smartphone into medical education and the growing concerns regarding digital distraction, further research is warranted to better understand this relationship.

Against this background, the present study was undertaken to determine the prevalence of smartphone addiction among undergraduate medical students and to examine its association with reading comprehension.

Understanding this relationship may help educators, curriculum planners, and policymakers develop strategies that promote healthy digital habits, encourage mindful use of technology, and enhance learning outcomes among future healthcare professionals.

Aim and objectives

The aim and objectives of the study were: to assess the prevalence of smartphone addiction among the undergraduate medical students, and to compare reading comprehension of smartphone addicted verses non-addicted medical undergraduate students.

METHODS

A web based cross-sectional study was conducted over a period of six months at F. H. Medical College, Etmadpur, Agra, from January to June 2026. The study population included all the students from the first to the final year of Bachelor of Medicine and Bachelor of Surgery (MBBS) enrolled in the undergraduate medical course at the institute as universal sampling method was used. The study included those students aged more than 17 years, who were enrolled in the MBBS course, students using smartphone for academic or non-academic purpose and those who willingly gave their consent to participate. Those students who refused to give consent or submitted the Google form incomplete were excluded from the study.

Taking the prevalence (p) of smartphone addiction from previous study to be 44.07%, with 5% absolute error (d), with a 95% level of confidence interval.¹⁸

$$\text{Sample size} = Z^2(1 - p)/d^2$$

The sample size was calculated as 394, taking 20% as non-response rate, the final sample size taken in the study was 504.

A predesigned and semi-structured proforma was administered through Google form which was circulated among WhatsApp group of first to final year of MBBS students. The first page of the form included information about the study objectives, voluntary nature of participation, confidentiality, and informed consent. After providing consent only new page open for further questionnaires to be filled. Duplicate responses were minimized by restricting one response per participant using their institutional google account. The google form consisted of 3 parts where part 1 was about socio-demographic details of the students, part 2 consisted of pattern of smart phone usage (smart phone addiction scale-short version) and part 3 was about level of use of smart phone for reading among students.

The short-version of the smart phone addiction scale (SAS-SV) is a validated instrument of 10 items/questions with 6-point Likert scale, originally developed by Kwon et al in Korea. The SAS-SV is made to address the following content areas: daily life disturbance, withdrawal, cyberspace-oriented relationship, overuse, anticipation and tolerance. The maximum total score of the scale from the 10 questions with 6 points each is 60 and minimum score is 10, cut-off values of 31 and 33 for male and female participants respectively was used to determine whether or not they were addicted to their smartphones.^{19,20}

Reading comprehension questionnaires

It is 10 items evaluating smart phone usage on academic reading understanding with 5-point Likert scale. The questions include “using smartphone for reading is much better than printed books, using smartphone for posting

content on social media and reading news rather than for studying with total score ranging from 10-50. A pilot study was conducted on 20 students for association of smartphone addiction and reading comprehension, where internal consistency of the questionnaire was assessed using Cronbach’s alpha. The overall Cronbach’s alpha coefficient was 0.714 (reading IMPACT). In present study internal consistency reliability of SAS-SV through Cronbach’s alpha was 0.852.

Responses were collected automatically and exported to Microsoft Excel and analysed using statistical package for the social sciences (SPSS) software. Mean, standard deviation was used (for continuous variables) and for frequency and percentages (for categorical variables), Chi-square t-test and regression were used to test the significance. Independent t-test was used to find correlation of reading comprehension with smart phone addiction and non-addicted group and representation was done using scatter plot.

RESULTS

A total of 504 undergraduate MBBS students participated in the present study. Of these, 232 (46.0%) were identified as having smartphone addiction, while 272 (54.0%) did not exhibit smartphone addiction, indicating that nearly one-half of the study population fulfilled the criteria for smartphone addiction. The findings suggest that smartphone addiction is a common behavioural problem among medical students and warrants further attention because of its potential impact on academic performance, mental health, and overall well-being.

Table 1 illustrates the gender-wise distribution of smartphone addiction among the study participants. Among 504 students, 140 (27.8%) male and 92 (18.3%) female were found to have smartphone addiction. Overall, 232 (46.0%) of the study population were categorized as smartphone addicted.

Table 2 presents the association between smartphone addiction and various socio-demographic and behavioural characteristics of the participants. Regarding age distribution, no statistical significance seen, students belonging to the age group of 23-25 years (36/70, 51.4%) demonstrated the highest proportion of smartphone addiction followed by age group of 20-23 years (138/284, 48.6%). Male students (140/258, 54.3%) were more common addicted to smartphone compared with (92/246, 37.4%) the female students, with gender also statistical significance seen ($p < 0.001$). Among student’s majority belong to nuclear family (69.4%) although smartphone addiction was more seen with joint family students. (49.4%) no significant association with smartphone addiction seen ($p = 0.321$). A statistically significant association was observed between smartphone addiction and the year of MBBS course ($p = 0.039$). With highest proportion among students studying in the second prof. MBBS (42/74, 56.8%).

Among behavioural factors, duration of smartphone uses per day reported a significant association with smartphone addiction ($p=0.001$). Ranging high among engaging ≥ 5 hours per day (64.4%) to lowest among using smartphone for 30 mins-1 hour (33.3%). Majority students primarily used smartphone for social media (53.6%), followed by watching videos (46.5%) and texting (45.5%) and least for research purposes (38%) and was not significantly associated with addiction ($p=0.108$). Majority student who used smartphone before sleep (49.6%) and use of smartphone before sleep for 1-2 hours (59.6%) both showed significant association with smartphone addiction ($p<0.001$).

Students who started their day by using smartphone (64.1%) exhibited significant association with smartphone addiction ($p<0.001$). Likewise, being uncomfortable without smartphone (60.3%) and majority of students reported craving to use smartphone during routine activities (68.8%) showed significant association with smartphone addiction ($p<0.001$).

Table 3 compares the reading comprehension-related smartphone use behaviours between students with smartphone addiction ($n=232$) and those without smartphone addiction ($n=272$). Independent sample t-tests were used to compare the mean scores of each statement between the two groups. Higher mean scores indicate greater agreement with the respective statement.

Students with smartphone addiction were considerably more likely to use their smartphone for reading social media posts and online news instead of academic content compared to the non-addicted students. (3.36 ± 0.85 versus 2.61 ± 1.01 , $p<0.001$). They also found difficulty in reading using Smartphone (2.95 ± 0.97 versus 2.48 ± 1.05 , $p<0.001$). Furthermore, students with smartphone addiction reported significant help in storing all lectures in one place in smartphone (3.07 ± 0.95 versus 2.71 ± 1.04 , $p<0.001$). Students with smartphone addiction agreed significantly that Smartphone distract them and they face greater difficulty concentrating on their studies (3.13 ± 0.947 versus 2.58 ± 0.99 , $p<0.001$). In addition, students with smartphone addiction are more likely to perceive screen size as a limitation for reading, despite continuing to use Smartphone extensively (2.68 ± 0.89 versus 2.47 ± 0.96 , $p=0.011$).

The students with or without smartphone addiction reported comparable level of agreement regarding smartphone are useful for accessing information to prepare lecture material (3.69 ± 0.81 versus 3.66 ± 1.05 , $p=0.66$). Although, addicted students reported slightly higher agreement that smartphone provide opportunities for learning beyond classroom teaching (3.67 ± 0.85 versus 3.52 ± 1.03 , $p=0.08$) and showed a slightly greater preference for printed books than smartphone-based reading (2.54 ± 0.99 versus 2.34 ± 1.09 , $p=0.3$), these variations were not statistically significant. Similarly, addicted students marginally agreed that smartphone

facilitate access to assignment-related resources (3.83 ± 0.799 versus 3.77 ± 0.964 , $p=0.42$) and recognized smartphone as useful educational tools for capturing images and reviewing them later (3.75 ± 0.809 versus 3.62 ± 1.01 , $p=0.124$) but no statistically significant association found.

Figure 1 shows a moderate positive correlation between smartphone addiction and reading comprehension as seen by the scatter plot. The computed rank correlation value was $R=+0.405$ ($p=0.000$). In linear regression analysis, the computed rank correlation value was $R^2=0.164$, which showed a weak positive correlation between smartphone addiction and reading comprehension. Reading comprehension explains 16% of variability in smartphone addiction score, while 84% are due to other remaining factors.

To identify the independent predictors of smartphone addiction after adjusting confounding variables multivariable binary logistic regression was applied (Table 4).

Among socio-demographic variables, the year of study of the participants was seen significantly associated with addiction of smart phone. Second year MBBS students have high odds of smart phone addiction of (AOR=2.17, 95% CI: 1.06–4.45; $p=0.035$) in comparison to first year students and MBBS third phase part II observed higher odds 2.61 times of having smart phone addiction (AOR=2.61, 95% CI: 1.29–5.28; $p=0.008$). Whereas age, gender, type of family, time spent on mobile phone per day, and the primary reason for smartphone use didn't show any independent association ($p>0.005$).

Amongst the smartphone usage behaviours, students who were not using smartphone before going to sleep had 66% less likely chance of developing smart phone addiction (AOR=0.34, 95% CI: 0.16–0.72; $p=0.004$) than those who used phone before sleep. In same way participants who did not feel uncomfortable without their smartphone had 58% lower odds of getting addicted to smart phone (AOR=0.42, 95% CI: 0.28–0.65; $p<0.001$) than who reported unease without their smart phone. Even, students who didn't happen to crave to use their smart phone during routine work showed significant reduced odds 62% of smartphone addiction (AOR=0.38, 95% CI: 0.24–0.61; $p<0.001$) compared to participants who experienced craving to use phone. Starting the day with smartphone use and duration of smartphone use before sleep didn't report any significant association as independent predictors for smartphone addiction ($p>0.05$).

Table 1: Prevalence of smart phone addiction among participants (n=504).

Gender	Smartphone addiction	Total (n)
Male	27.8% (140)	46% (232)
Female	18.3% (92)	

Table 2: Association of smartphone addiction with socio-demographic and behavioural characteristics.

Variables	No smartphone addiction (n=272), N (%)	Smartphone addiction (n=232), N (%)	Total (n), N (%)	P value
Age (years)				
17-20	58 (64.4)	32 (35.6)	90 (17.9)	0.126
20-23	146 (51.4)	138 (48.6)	284 (56.3)	
23-25	34 (48.6)	36 (51.4)	70 (13.9)	
>25	34 (56.7)	26 (43.3)	60 (11.9)	
Gender				
Male	118 (45.7)	140 (54.3)	258 (51.2)	0.000
Female	154 (62.6)	92 (37.4)	246 (48.8)	
Type of family				
Nuclear	194 (55.4)	156 (44.5)	350 (69.4)	0.321
Joint	78 (50.6)	76 (49.4)	154 (30.6)	
Years of course				
MBBS 1 st prof.	82 (63.0)	48 (37.0)	130 (25.7)	0.039
MBBS 2 nd prof.	32 (43.2)	42 (56.8)	74 (14.6)	
MBBS 3 rd part 1	88 (54.3)	74(45.7)	162 (32.1)	
MBBS 3 rd part 2	70 (50.7)	68 (49.3)	138 (27.3)	
Time spent on mobile (hours/day)				
½-1	24 (66.6)	12 (33.3)	36 (7.1)	0.001
1-2	60 (63.8)	34 (36.2)	94 (18.7)	
3-4	136 (59.6)	92 (40.4)	228 (45.2)	
>5	52 (35.6)	94 (64.4)	146 (29)	
Reason for mobile use				
Texting	12 (54.5)	10 (45.5)	22 (4.4)	0.108
Social media	90 (46.4)	104 (53.6)	194 (38.5)	
Gaming	6 (60)	4 (40)	10 (2)	
Study or research	88 (62)	54 (38)	142 (28.2)	
Watching videos	46 (53.5)	40 (46.5)	86 (17.1)	
Others	30 (60)	20 (40)	48 (9.9)	
Use of smartphone before sleep at night				
Yes	224 (50.5)	220 (49.5)	444 (88.1)	0.000
No	48 (80)	12 (20)	60 (11.9)	
Time spent on smartphone before sleep				
30 mins-1 hour	206 (60.2)	136 (39.8)	342 (67.9)	0.0001
1 hour-2 hour	46 (40.4)	68 (59.6)	114 (22.6)	
>2 hours	20 (41.7)	28 (58.3)	48 (9.5)	
Start day with smartphone use				
Yes	74 (35.9)	132 (64.1)	206 (40.9)	0.0001
No	198 (66.4)	100 (33.6)	298 (59.1)	
Uncomfortable without smartphone				
Yes	96 (39.7)	146 (60.3)	242 (48)	0.0001
No	176 (67.2)	86 (32.8)	262 (52)	
Craving for using smartphone during routine work				
Yes	58 (31.2)	128 (68.8)	186 (36.9)	0.0000
No	214 (67.3)	104 (32.7)	318 (63.1)	

Table 3: Reading comprehension related behaviours comparison among smartphone addicted students and without addicted students using independent t-test.

Level of use of smartphone for reading among the students	No smartphone addiction (n=272) (mean±SD)	Smartphone addiction (n=232) (mean±SD)	t-value	P value
Using smartphone for posting content on social media and reading news rather than for studying	2.61±1.009	3.36±0.85	-8.95	0.00
Using smartphone for reading is a difficult task	2.48±1.05	2.95±0.97	-5.213	0.00
Smartphone makes it easier to grab information online and offline ahead of lectures	3.66±1.05	3.69±0.81	-0.438	0.661
Using the smartphone for reading has empowered to learn new skills and gain valuable experiences beyond the classroom	3.52±1.03	3.67±0.85	-1.707	0.089
Using Smartphone for reading is much better than printed books	2.34±1.09	2.54±0.99	-2.102	0.30
Smartphone reduces the effort required to find answers to assignment online or offline	3.77±0.964	3.83±0.799	-0.804	0.422
Smartphone helps to take a screenshot of information which can be reviewed at any time later	3.62±1.01	3.75±0.809	-1.542	0.124
Smartphone helps to store all lecture materials in one place	2.7132±1.04	3.07±0.95	-4.079	0.000
Smartphone makes it hard to concentrate on studies, therefore avoiding it for learning	2.58±0.99	3.13±0.947	-6.333	0.000
Rarely use smartphone for reading because of its small screen size	2.47±0.96	2.68±0.886	-2.549	0.011

Table 4: Multivariable binary logistic regression analysis of factors associated with smartphone addiction among undergraduate medical students (n=504).

Variables	No smartphone addiction (n=272), N (%)	Smartphone addiction (n=232), N (%)	AOR	95% C.I.	P value
Age (years)					
17-20	58 (64.4)	32 (35.6)	Ref.		
20-23	146 (51.4)	138 (48.6)	0.887	0.474-1.657	0.706
23-25	34 (48.6)	36 (51.4)	0.790	0.336-1.857	0.588
>25	34 (56.7)	26 (43.3)	0.534	0.212-1.345	0.183
Gender					
Male	118 (45.7)	140 (54.3)	Ref.		
Female	154 (62.6)	92 (37.4)	0.836	0.547-1.278	0.409
Type of family					
Nuclear	194 (55.4)	156 (44.5)	Ref.		
Joint	78 (50.6)	76 (49.4)	0.976	0.619-1.53	0.915
Years of course					
MBBS 1 st prof.	82 (63.0)	48 (37.0)	Ref.		
MBBS 2 nd prof.	32 (43.2)	42 (56.8)	2.170	1.058-4.450	.035
MBBS 3 rd part 1	88 (54.3)	74 (45.7)	1.472	0.792-2.733	0.221
MBBS 3 rd part 2	70 (50.7)	68 (49.3)	2.607	1.288-5.277	0.008
Time spent on mobile (hours/day)					
½-1	24 (66.6)	12 (33.3)	Ref.		
1-2	60 (63.8)	34 (36.2)	0.592	0.234-1.49	0.269
3-4	136 (59.6)	92 (40.4)	0.852	0.352-2.061	0.722
>5	52 (35.6)	94 (64.4)	0.857	0.319-2.3	0.759
Reason for mobile use					
Texting	12 (54.5)	10 (45.5)	Ref.		

Continued.

Variables	No smartphone addiction (n=272), N (%)	Smartphone addiction (n=232), N (%)	AOR	95% C.I.	P value
Social media	90 (46.4)	104 (53.6)	1.385	0.453-4.24	0.568
Gaming	6 (60)	4 (40)	0.569	0.95-3.414	0.537
Study or research	88 (62)	54 (38)	0.967	0.32-2.9	0.953
Watching videos	46 (53.5)	40 (46.5)	0.597	0.183-1.9	0.392
Others	30 (60)	20 (40)	1.450	0.419-5.02	0.558
Use of smartphone before sleep at night					
Yes	224 (50.5)	220 (49.5)	Ref.		
No	48 (80)	12 (20)	0.342	0.163-0.716	0.004
Time spent on smartphone before sleep					
30 mins-1 hour	206 (60.2)	136 (39.8)	Ref.		
1 hour-2 hour	46 (40.4)	68 (59.6)	1.637	0.94-2.8	0.81
>2 hours	20 (41.7)	28 (58.3)	1.128	0.508-2.507	0.767
Start day with smartphone use					
Yes	74 (35.9)	132 (64.1)	Ref.		
No	198 (66.4)	100 (33.6)	0.692	0.43-1.09	0.118
Uncomfortable without smartphone					
Yes	96 (39.7)	146 (60.3)	Ref.		
No	176 (67.2)	86 (32.8)	0.422	0.276-0.645	<0.001
Craving for using smartphone during routine work					
Yes	58 (31.2)	128 (68.8)	Ref.		
No	214 (67.3)	104 (32.7)	0.381	0.240-0.607	<0.001

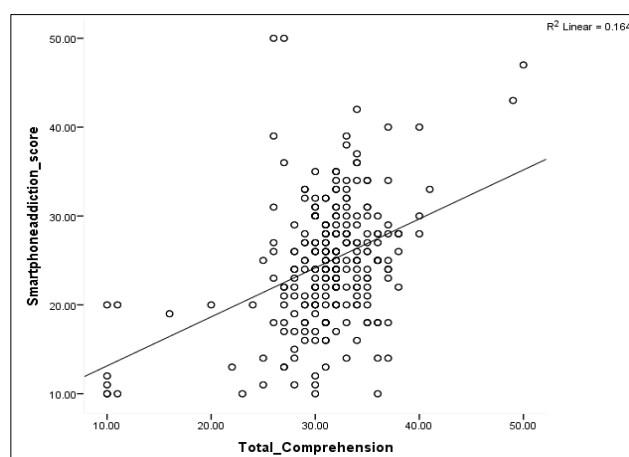


Figure 1: Scatter plot graph showing correlation between reading comprehension and smartphone addiction.

DISCUSSION

The overall pooled prevalence of smartphone addiction among medical students in India is approximately 60% as reported by systematic review and meta-analysis article including 24 studies done by Pradeep et al.²¹ In present study showed slight lower smartphone addiction prevalence of 46% which is in line with many studies Devi et al (39.9%), Swathe et al (41.58%), and Kagathara et al (42.04).²²⁻²⁴ On contrary to the findings several studies have documented a higher prevalence of smartphone addiction such as Jain et al (56.58%), Singh et al (54.1%), Hada et al (66%) and Kumar et al (51%). An even much

higher prevalence of 72.7% was concluded by Chaudhuri et al.^{19,25-28} The smartphone usage is much high among adolescent and young adults of college as they may be attributed to emotional vulnerability, less of parental oversight, leisure time for digital experiments and much easier option to gather more information on academic purposes.

This present study found that 27.8% of male are more addicted to smartphone than females 18.3% as they are more mobile game challenges catered and to improve technical knowledge, these findings are in consistent with study done by Hada et al 55% and 46%, Kagathara et al 48% and 35% for male and females respectively.^{24,26} However, Shree Hari et al reported females having slight higher smartphone addiction than males owing to their much social media usage and digital platforms for friends networking.²⁰

Gender was found statistically significant association to smartphone addiction in our study ($p > 0.000$) but on regression analysis didn't observe as a significant predictor to occurrence of the smartphone addiction, similar findings were reported by Phukan et al and Shree Hari et al.^{18,20}

Most of participants in this study spent 3-4 hours per day on smartphone which is in agreement with Babu et al, Phukan et al and Kagathara et al, and in contrast with Verma et al and Sreehari et al concluded 4-6 hours of smartphone use per day by majority students.^{18,20,24,29,30} Furthermore, Most of the participants primarily used smartphone to access social media (38.5%) similar findings observed in consistent with studies Phukan et al

and Babu et al, but none of these variables satisfy as an independent predictor for smartphone addiction.^{18,29}

In the present study majority of students watch smartphone before going to sleep with most spending 30 minutes to 1 hour on their devices in bed before bedtime which showed as a significant predictor to smartphone addiction through regression analysis, similar findings were in line with Devi et al.²² Majority participants belonged to nuclear family but didn't observe association with smartphone addiction in contrast to study conducted by Devi et al.²² Students who felt uncomfortable without phone and had craving for their phone during routine work were observed as significant predictors to smartphone addiction in our study.

The present study described the positive correlation between reading comprehension and smartphone addiction score ($r=0.405$, $p=0.00$) with scatter plot figure and on linear regression $R^2=0.164$ showing weak positive association suggested that 16.4% of variation in reading comprehension score could be explained by smartphone addiction score. Similar scatter plot analyses were demonstrated in Singh et al who also concluded a positive association between smartphone addiction and sleep quality (PSQI) $r=0.172$ and another study by Kagathara et al also reported positive correlation through scatter plot between DASS anxiety scale and addiction score ($r=0.620$).^{24,25} As per Amirthraja et al, Subaveerapandiya et al majority 67% preferred printed books for ease of studying and making notes than e books which is in contrast to the present study, majority addicted students use smartphone based reading than printed books.^{31,32}

Since the usage of smartphone for academic understanding questionnaires including poor reading score and even better reading scores items equally it is very difficult to discuss the correlation of reading comprehension to smartphone addiction ($r=0.305$ positive association), the relatively weak correlation coefficient $r^2=0.164$ suggests that 16% variability in smart phone addiction affect the reading comprehension of MBBS students hence it is understood that smartphone addiction is one among the several other variable like study habits, learning strategies, sleep quality, academic motivation, psychological stress, and environmental factors contributing to students reading comprehension. In contrast to present study finding, Heisch et al study reported a negative correlation ($r=-0.12$) between smartphone usage frequency and academic performance mainly emphasis on multitasking with smartphone during class time.³³

Over all, the findings emphasis on the importance of promoting healthy smartphone use among undergraduate medical students.

Limitations

As the present study is web based crossectional study, the causality or temporal association of various factors with

smartphone addiction are not well established, there is need of longitudinal research studies to be done to explore more into smartphone addiction and its long-term impact on physical, mental, social and academic outcomes. As data were collected through self-administered google form, there is high chance of selection and recall bias which might affect accuracy of the result of study. Since the present study included one private medical college, the results cannot be generalised to various other educational settings. To assess the academic performance there has to be standardised assessment instruments to be operationalised to analyse cognitive, behavioural, psychological dependence on phone, academic stress level and not just on basis of numerical academic test results.

CONCLUSION

The present study highlights the high prevalence 46% of smartphone addiction among students and has become an alarming public health concern in the community. Behavioural factors like craving for phone during routine activities, feeling discomfort without phone and use of phone before sleep stood out as independent predictors for smartphone addiction. The study concluded a statistically significant positive correlation between reading comprehension and smartphone addiction explaining the profound influence of smartphone usage on academic performance. Hence there is need to develop digital monitor app to keep a check on smartphone activities. To bring out various intervention strategies in the community and educational settings through awareness programmes, campaigns, to develop appropriate technology to assess reading comprehension among students.

ACKNOWLEDGEMENTS

Authors would like to thank to administration of F. H. Medical College and Hospital, Agra, Uttar Pradesh, India. They would also like to thank all undergraduate students of MBBS, who voluntarily participated in the study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Manju M, Rao S, Qureshi MA, Khan FH. Smart phone addiction and reading comprehension among medical undergraduates: a cross-sectional study. *Int J Community Med Public Health* 2026;13:4889-98.