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Smartphone addiction among undergraduate medical students and its association with academic performance

Abstract

Background and aims: Smartphones have become an indelible part of a student's life; but, their effect on academic performance of medical students is unclear with sparse data. The objective of the study was to estimate the prevalence of smartphone addiction among undergraduate medical students, pattern of its use, and the association of smartphone addiction with academic performance. **Method:** We conducted a cross-sectional study on all the undergraduate medical students in the Medical College Baroda, Anandpura, Vadodara, Gujarat, India, from second year to internship after getting written informed consent. Sociodemographic details, patterns of smartphone use, and scores of the final examination appeared for, were obtained to assess academic performance using a self-report semi-structured questionnaire. Smartphone addiction was diagnosed using the Smartphone Addiction Inventory (SPAI). **Result:** Out of the 523 students approached, 427 returned completed questionnaires. Ninety five students (22.2%) had smartphone addiction, with the addicted students being more likely to change their phone often, use it for longer periods and in restricted places. No association was found with gender, age, years of use, and academic performance. **Conclusion:** Nearly one-fifth of the medical undergraduate students were suffering from smartphone addiction. However, it does not seem to have an association with academic performance among undergraduate medical students.

Keywords: Addictive Behaviour. Dependence. Education. Medical School.

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INTRODUCTION

Smartphones are mobile phones with continuous internet connectivity with all the benefits and problems associated with internet. The availability of low-cost smartphones and the affordability of internet services in India have made it accessible to the masses. Most of the expanding market is composed of young adults with a majority of them using their phones for around three-hour daily. This makes college students a likely target for overuse and all the problems that it entails.[1] This has led to a plethora of research into smartphone addiction and its impact.

Internet addiction was the first technological addiction to be studied in detail. Dr. Young enumerated the criteria for internet addiction based on the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for pathological gambling due to the similarities between the two.[2] Mounting phenomenological, genetic, and neurobiological evidence suggests a definite link between substance use disorders and behavioural addictions such as pathological gambling, internet addiction, and compulsive buying.[3]

Various studies across Europe and the United States of America (USA) show addiction rates between five and 38% among adolescent and adult populations.[4-6] Studies from Asia, including Japan observed the rates between 2.9 to 27.4%.[7-9] In India, the prevalence of smartphone addiction ranged from 39-44% among adolescents.[10] Studies done on graduate and postgraduate students observed that a third of them suffered from at least three symptoms of dependence.[11] The wide range of prevalence may be due to difference in method/scale used, sociocultural adoption, availability and affordability of technology.

Smartphones are an indelible part of a medical students' life with a wide range of uses. In a university in Malaysia, most undergraduate medical students owned a smartphone and half of them used a medical app at least once a day. Majority of them used medical apps for the purpose of looking up medical information instantly (93%) and during ward rounds

(87%).[12] Payne *et al*.[13] reported that medical students and doctors in the United Kingdom (UK) spend an average of half an hour on apps for learning; with the most popular ones being for disease diagnosis/management and drug reference among students, and clinical score/medical calculator among doctors.

In India, Aggarwal *et al*.[14] found that 40% resident doctors were addicted to mobile phones based on the tenth revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10) dependence criteria with a fifth of them assessing themselves to be addicted. Among medical students, 18.5% were found to be nomophobes.[15] Subba *et al*.[16] noted that medical students who had ring anxiety (34.5%) felt that their studies were hampered by the excessive use of the phone.

In a comprehensive study by Lepp *et al*.[17] in USA on undergraduate students, academic performance was noted to be negatively correlated with cell phone use after controlling for demographic factors, high school grades, self-efficacy, and self-regulated learning. The effect of related forms of technology on academic performance is ambiguous with results ranging from no effect of excessive Facebook use on grades[18] to negative effects on college grades and lesser hours spent studying.[19] Junco[20]observed that Facebook use was associated with poorer academic achievements after controlling for gender, ethnicity, socioeconomic strata, and high school grades. Michikyan *et al*.[21] suggested that academic performance may determine college students' Facebook use, rather than the reverse.

The research done so far alludes that smartphone addiction is a tangible problem among adolescents and young adults. However, no comprehensive study has been conducted regarding its impact on academic performance, especially in medical students. Hence, this study looked into the prevalence of smartphone addiction among the undergraduate medical students, its pattern of use, and its association with academic performance among undergraduate medical students.

MATERIAL AND METHODS

Participants

It is an observational cross-sectional study conducted on undergraduate medical students in the Medical College Baroda, Anandpura, Vadodara, Gujarat, India, where 180 students take admission every year. All the students from second year up to internship (n=572) having smartphones were included who gave written informed consent. First years were not included as they had not yet appeared for the final examination. Approvals were taken from the college authorities and the Institutional Ethics Committee prior to data collection. All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

Out of the 180 students in each batch, some dropped out of the batch because of failure or ineligibility to attend final examinations (failure in preliminary examinations, low attendance, drop out, illness, etc.) in the previous year. These minor batches were not included in the study due to very less number of students and poor attendances in each such batch. We got the second years before their results came out and hence, got the full batch. As we approached them in class, we could not get everyone. More than half the intern batch leaves to do rotations in other colleges so we could not include them either. Therefore, though the count should be 720, all the students could not be included.

Measures

A pretested, semi-structured, self-report questionnaire was used to collect data regarding demographic variables, patterns of use of the smartphone, academic performance, and students' subjective assessment of their own performance. Details of academic performance (result of the final examination taken) were collected from the students and confirmed by records from the college office. Patterns of use was determined by hours of daily use, places of use, purpose of use along with the duration for each purpose, types of social networking sites used, and academic use of the phone.

The Smartphone Addiction Inventory (SPAI) was used to assess smartphone addiction. It is a 26-item self-report questionnaire developed by Lin *et al*.[22] based on a four-point Likert scale, one=strongly disagree, two=somewhat disagree, three=somewhat agree, and four=strongly agree, with total score ranging from 26-104. It is a modification of the Chen Internet Addiction Scale (CIAS). It assesses smartphone addiction on the basis of the five factors used to diagnose internet addiction, namely compulsive use, tolerance, withdrawal, time management issues, and functional impairment. Exploratory factor analysis revealed four factors to be significant and are included in the scale as four sub-scales, namely compulsive use, withdrawal, tolerance, and functional impairment. The scale has good internal consistency with a Cronbach's alpha of 0.94 and test-retest reliabilities (interclass correlation 0.74-0.91).[22] The developers of the scale did not mention a specific cut-off value. However, it is entirely based on CIAS which has shown highest diagnostic accuracy at a cut-off of 64 (87.6% were diagnosed correctly) with a sensitivity of 85.6%.[8]

Pilot study

A short pilot study was conducted on 75 students (20 randomly selected students from each batch and 15 intern doctors), to ensure that the questions were clear and to determine the areas requiring more focus during the larger study. The results of the pilot study helped determine the cut-off point that would be most appropriate for diagnosing smartphone addiction in our population. Each student was administered SPAI and was clinically interviewed by an experienced psychiatrist to diagnose them with smartphone addiction. The Cronbach's alpha was determined to be 0.92. On examination of the receiver operating characteristics (ROC), the area under the curve (AUC) value was established at 0.946 (with a 95% confidence interval of 0.869-0.985). At a cut-off of 63, the sensitivity was determined to be 83.3% and the specificity was 96.83%. This was considered adequate and hence, a score of 63 and above was taken to diagnose smartphone addiction.

Data collection

Students were approached in class after giving prior intimation to the class representative. Students were informed that full confidentiality would be maintained. Attendance was taken in each session to ensure that no student was interviewed repeatedly and also to identify the missing students. Each batch was approached twice to include as many participants as possible. Later, another attempt was made to contact absent students individually. It usually took around 45 minutes to fill-up the questionnaires and each question/item was explained before responding.

Statistical analysis

Data was entered in the excel sheet and kept in password-protected format to ensure confidentiality. Data was analysed using STATA IC-13. Descriptive statistics were used to present details of demographics and patterns of smartphone use. Associations were sought between presence or absence of smartphone addiction and academic performance using t-test and Pearson's correlation coefficient. P value lesser than 0.05, i.e. $P<0.05$ has been considered as statistically significant. Differences in duration of use of smartphones for different purposes among smartphone addicts and non-addicts were checked using Mann Whitney test. Other factors investigated were the associations between addiction and gender, age, years of use, how often they buy a phone, hours of use both academic and non-academic, whether they use it in class and hours of study were assessed using Chi-square test.

RESULTS

Out of 572 students, 523 could be contacted and 427 completed questionnaires were obtained. Smartphone addiction (SPAI score ≥63) was found in 95 students (22.2%).

With regard to frequency of buying a phone, 43% of the addicted students bought a new phone every one to two years whereas, for non-addicted students, most reported that this was their first phone. Those with addiction also tended to use the phone for longer periods of time with a significant mean difference of almost one hour daily (Table 1).

Patterns of use

A discernable difference in the rates of usage of the phone in various restricted places such as the classroom, library, and during commuting was found between the addicted and non-addicted groups. The patterns of use of social networking sites were different with a higher proportion of addicted students using Facebook/Twitter, Voice over Internet Protocol (VoIP) apps like Skype/Viber and photo-sharing sites like Instagram. In terms of academic use of the phone, 65% of the addicted students used the phone to read books and journals compared to 50% of the non-addicted students. There was a statistically significant

Table 1: Demographic variables and patterns of owning and using smartphones among smartphone addicts and non-addicts

Variables/patterns	Non-addicts (SPAI<63) number of students n=332 (%)	Addicts (SPAI≥63) number of students n=95 (%)	Total number of students n=427 (%)	Chi-square/ t-test value	P value
Demographics					
Males	173 (52.1)	58 (60.1)	231 (54.1)	2.03	0.154
Females	159 (47.9)	37 (38.9)	196 (45.9)		
Age (average, in years)	20.92 (±2.28)	20.76 (±1.95)	20.8	0.95	0.343
Specifications of smartphone use					
Number of phones					
1	312 (93.9)	85 (89.4)	397 (92.97)	1.65	0.198
≥2	20 (6.0)	10 (10.5)	30 (7.03)		
Number of active sim cards					
1	218 (65.6)	54 (56.8)	272 (63.7)	2.12	0.145
≥2	114 (34.3)	41 (43.2)	155 (36.3)		
How frequently do they buy a smartphone					
<1 year	8 (2.4)	7 (7.3)	15 (3.5)	20.29	**<0.001**
1-2 years	87 (26.2)	41 (43.2)	128 (30)		
>2 years	87 (26.2)	24 (25.2)	111 (26)		
First phone	150 (45.2)	23 (24.2)	173 (40.5)		
Owning and using a smartphone (in years)	3.017 (±1.26)	3.08 (±1.28)	3.03 (±1.26)	0.04	0.67
Average duration of use daily (in hours)	3.25 (interquartile range 2-5)	4 (interquartile range 3-6)	4 (interquartile range 2-6)	2.86	**0.004**

SPAI: Smartphone Addiction Inventory

Table 2: The usage patterns of smartphone among addicted and non-addicted students

Usage patterns	Not addicted (n=332) n (%)	Addicted (n=95) n (%)	Chi-square value	P value
Places of use				
Classroom	241 (72.5)	81 (85.2)	5.73	**0.017**
Bathroom	163 (47.7)	56 (64.7)	7.69	**0.006**
Library	157 (47.2)	62 (65.2)	8.85	**0.003**
While commuting	123 (37.0)	54 (56.8)	11.12	**0.001**
Social media				
Facebook/ Twitter	247 (74.3)	84 (88.4)	7.55	**0.006**
WhatsApp/ messenger	315 (94.8)	91 (95.7)	0.01	0.962
Instagram	115 (34.6)	48 (50.5)	7.24	0.129
Viber/ Skype	34 (10.2)	23 (24.2)	11.28	**0.001**
Academic use of the smartphone				
Browsing	309 (93.0)	92 (96.8)	1.24	0.266
Watching videos	257 (77.4)	70 (73.6)	0.38	0.536
Reading journals/ books	169 (50.9)	62 (65.2)	5.57	**0.0183**

difference in the use of dictionaries/calculators amongst the two groups (Table 2).

Table 3 depicts a significant difference between addicted and non-addicted in recreational use.

According to the four subscales defined by the developers of the scale, the addicted students scored the highest in the tolerance subscale with a tolerance tendency of 3.03. The compulsive, tolerance, withdrawal, and functional impairment tendencies are the average of the scores (total score divided by the number of items in each subscale) obtained in each of the subscales with a score range of one to four. The scores in the other tendencies are 2.76, 2.78, and 2.68 for compulsive use, withdrawal, and functional impairment respectively.

Smartphone addiction and academic performance

The P value found on comparing the mean scores of the most recent examination appeared for among addicts and non-addicts was 0.452 which is not statistically significant. As each year's syllabus content is different, students of individual years were compared among themselves also. The results were not found to be statistically significant between addicts and non-addicts in each year.

Almost half of the students in both groups reported that they were satisfied with their college performance. The non-addicted students spent about 45 minutes more on studies daily as compared to the addicted students.

As no objective data is currently available regarding the cut-off point of SPAI in this population, we used the scale as a continuous variable as well. The Pearson's correlation coefficient (r) between SPAI scores and hours of smartphone use with results of examinations appeared for last was found to be -0.04 and -0.02, respectively. It shows a very weak negative relation between SPAI scores and hours of smartphone use with results of examinations appeared for last.

Table 3: The duration of use of smartphones for different purposes among smartphone addicts and non-addicts

Purpose of use	Median duration in hours (interquartile range)		Mann Whitney test	
	Non-addicted (SPAI<63)	Addicted (SPAI≥63)	Z value	P value
Academic	0.5 (0.75)	0.5 (0.75)	-0.856	0.392
Recreational	2 (1.10)	3.0 (4.0)	-4.262	**<0.001**
Utility	0.7 (1.10)	1 (1.29)	-1.332	0.189

DISCUSSION

Prevalence

A fifth of the students were found to be addicted to smartphones, which is comparable to the rate observed by using a similar scale based on the five hypothesised factors for behavioural addictions and gambling.[6] Among Asian countries, the rate was 11.4%, using a scale based on the five factors of addiction,[8] while in China, the prevalence ranged from 13.5 to 23.3% of university students using a scale based on Young's Internet Addiction Test and another using the criteria for Mobile Phone Dependence Syndrome.[7,9] A study conducted on smartphone addiction among the young population in Switzerland also had similar results. It concluded that the overall addiction rate was 16.9%, with younger adolescents (15-16 years) having a higher rate than older people (19 years and above).[23] The studies done in India showed a range of 27 to 33% among medical postgraduate and graduate students, respectively using questionnaires based on the ICD-10 criteria for substance abuse.[11,14] Similar rates were found for ring anxiety.[16]

Patterns of use

This study found no association of smartphone addiction with gender, age, and years of use of the phone. This is similar to the findings of Dixit *et al*.[15] who observed no significant

difference in the gender or year of study among those with and without smartphone addiction.

Those with addiction were more likely to frequently change phones (every one to two years) in comparison with those without addiction (majority were still using their first phone). They also tend to use the phone for longer hours daily considering one of the five factors of addiction: tolerance, i.e. requirement for more gadgets and spending a greater amount of time on the phone. The difference in the total daily duration of use between the two groups can be explained by the longer time spent on recreational activities by those who are addicted. Aggarwal *et al.*[14] saw that among resident doctors, the average duration of use was 1.8 hours with the majority using it primarily for calling and texting, and three hours among young adults primarily on calling and playing games.[11] Haug *et al.*[23] also found that the addicted group used the phone for longer periods of time and started using the phone earlier in the day.

A greater proportion of students with smartphone addiction used the phone in restricted situations like during class, in the library and bathroom, or while driving when compared to those without addiction. This is similar to the findings of Subba *et al.*[16] who found a comparable proportion of students with ring anxiety using their phones in the aforesaid situations. Dixit *et al.*[15] also observed that a fifth of the students interviewed use it during college hours and feel distressed at not having access to their phones.

Academic performance

This study found no association between smartphone use/addiction and academic performance among undergraduate medical students. This is in contrast to previous studies conducted on medical students who perceived that their smartphone usage was negatively affecting their academics. However, no comment was made on the objective performance of these students.[16] Lepp *et al.*[17] reported that when measured against hours of cellphone use, undergraduate students who used the phone for longer duration showed a poorer performance in examinations after taking into account the variations caused by demographic factors, inherent abilities, and motivation of the students giving a more holistic picture of the situation. However, the major difference between this study and ours was that it was conducted on university students taking different courses.

The contrasting results can be explained by the fact that the study population is composed of a group of highly intelligent and motivated individuals. Only those who excel in the high school examinations and competitive entrance examinations get admitted to this course. Although a substantial number of students use their phone excessively, it is not associated with academic decline. When the entire population was analysed, no association was found between academic performance and smartphone addiction. This could also be attributed to the fact that different students took different examinations. However, when each year was compared individually, no association was found, either. This analysis may be underpowered by the reduced number of students and the high functioning characteristic of the population. As these are bright and driven students, a larger population may be required to increase the power of the study.

Another factor involved is that examinations occur at the end of the term while the study was conducted in the middle of the term. It is common for some students to spend most of the year at ease followed by a few months of intense preparation just prior to the examinations. A higher proportion of the addicted students were found to use their phone for reading books/journals. This may contribute to the equitable grades obtained in spite of spending more time on the phone. Other studies found that the general consensus amongst the students was that medical apps are essential for undergraduate medical students; they save time by providing instant access to guidelines and other information, and supplement conventional methods of learning.[12]

Limitations

This study is a cross-sectional study, conducted in the middle of the academic year when both study patterns and mobile phone use patterns could be different from that nearing the end of the term. For a more accurate perspective, a multi-centric, longitudinal study is likely to yield more information while analysing students in individual years.

Conclusion

A substantial number of students (22.2%) suffered from smartphone addiction. Those diagnosed with addiction used the phone for a longer duration than those without addiction, were more likely to change their phones often and use it in restricted situations like in the classroom, bathroom, and while driving. No association was found between smartphone use/addiction and academic performance; both in terms of scores in last examination and subjective assessment of their own performance.

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CONTRIBUTIONS

All the authors have been personally and actively involved in substantive work leading to the report, and hold themselves jointly and individually responsible for its content.

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