Original Article

Addiction-like Behavior Associated with Mobile Phone Usage among Medical Students in Delhi

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ABSTRACT

Background: Mobile phone addiction is a type of technological addiction or nonsubstance addiction. The present study was conducted with the objectives of developing and validating a mobile phone addiction scale in medical students and to assess the burden and factors associated with mobile phone addiction-like behavior. **Materials and Methods:** A cross-sectional study was conducted among undergraduate medical students aged ≥18 years studying in a medical college in New Delhi, India from December 2016 to May 2017. A pretested self-administered questionnaire was used for data collection. Mobile phone addiction was assessed using a self-designed 20-item Mobile Phone Addiction Scale (MPAS). Data were analyzed using IBM SPSS Version 17. **Results:** The study comprised of 233 (60.1%) male and 155 (39.9%) female medical students with a mean age of 20.48 years. MPAS had a high level of internal consistency (Cronbach's alpha 0.90). Bartlett's test of sphericity was statistically significant ($P < 0.0001$), indicating that the MPAS data were likely factorizable. A principal component analysis found strong loadings on items relating to four components: harmful use, intense desire, impaired control, and tolerance. A subsequent two-stage cluster analysis of all the 20-items of the MPAS classified 155 (39.9%) students with mobile phone addiction-like behavior that was lower in adolescent compared to older students, but there was no significant difference across gender. **Conclusion:** Mobile phone use with increasing adoption of smartphones promotes an addiction-like behavior that is evolving as a public health problem in a large proportion of Indian youth.

Key words: *Addiction, India, mobile phone, nomophobia, smartphone*

INTRODUCTION

Mobile phone provides a medium of communication that has found enthusiastic and nearly universal adoption globally in both developed and developing nations. India has the second highest mobile connections in the world after China, with more than 90 connections per 100 people.[1] Mobile phones, in the last decade, have evolved from a primary tool of interpersonal communication to that facilitating group communication.[2] This transformation has been enabled by the integration of mobile Internet facilities and exponential increase in the computing power of mobile phones, converting them into smartphones. A multitude of leisure activities drive smartphones usage, which include mobile gaming, streaming music,

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and photo and video sharing on social networks like Facebook, Twitter, WhatsApp, Instagram, etc. The number of smartphone users in developing countries like India is showing, a rapidly increasing trend especially in young, urban populations, with nearly one in three mobile phone users expected to be smartphone users by 2021.[3]

Technological addiction is a form of nonsubstance addiction that has been previously defined as the compulsion by an individual to engage in some specific activity despite harmful consequences as deemed by the user himself/herself to his/her individual health, mental state, or social life.[4] Mobile phone usage characterized by addiction-like behavior represents a specific form of technological addiction. In this regard, nomophobia is a related phenomenon that refers to discomfort, anxiety, nervousness, or anguish caused by being out of contact of mobile phone and associated technology. The characteristics of nomophobia vary and could include regular use of mobile phone, anxiety or nervousness caused in the absence of access to mobile phone or mobile network, repeated checking of the mobile screen for notifications, sleeping with mobile device in bed, and preference for mobile interaction opposed to face-to-face exchanges.[5]

Some studies had reported the presence of a high burden of Internet addiction and mobile phone addiction-like behavior and nomophobia among Indian youth.[6-11] However, the previously validated instruments used for assessment of mobile phone addiction and nomophobia in Indian populations have certain limitations. The nomophobia questionnaire (NMP-Q) developed by Yildirim *et al*. measures nomophobia in mobile phone users.[12] However, some items in the NMP-Q, like a person's annoyance on not being able to access, or feeling stranded in absence of the mobile phone, may not necessarily reflect nomophobia in the Indian scenario where mobile Internet is the principal means of Internet access for millions of young people, but safety concerns in public spaces for women can be ameliorated through mobile phone connectivity.[13]

The questionnaire to assess mobile phone addiction-like behavior by Aggarwal *et al*.[14] belongs to the presmartphone era and does not consider the potential for technological addiction arising from the built-in Internet facilities, social networking, and the Internet-based messaging services available in smartphones.

It is important to develop and validate a mobile phone addiction scale in a suitable Indian population, which takes into account the combined risk arising from both the conventional mobile phone and the Internet-based

applications available in smartphones. Furthermore, the high prevalence of stress and burnout in medical students during their period of education is well established, which renders them at risk of developing addictions.[15,16]

The present study was thus conducted with the objectives of developing and validating a mobile phone addiction scale in medical students and to assess the burden and factors associated with mobile phone addiction-like behavior.

MATERIALS AND METHODS

A cross-sectional study was conducted among undergraduate medical (MBBS) students at a prominent medical college of Delhi, India from December 2016 to May 2017. Students aged ≥18 years were included.

Based on a previous study, the burden of mobile phone addiction was expected to be 50%.[9] The sample size at 95% confidence levels and 5% margin of error was calculated to be 384. The final sample size is estimated to be 450 after considering an anticipated 15% nonresponse and rounding off. The medical college has five undergraduate batches of students. From each of the batches, 90 students were selected through simple random sampling.

A pretested self-administered questionnaire was used to inquire regarding mobile phone use patterns. The pretesting was conducted in 25 students who were not a part of the final study. Content validity was assessed by a group of professionals, and modifications were made to the questionnaire at this stage.

Mobile phone addiction was assessed using a 20-item self-designed Mobile Phone Addiction Scale (MPAS), which was constructed based on a literature search and also included questions from other questionnaires.[14,17,18] The items in the MPAS were designed for assessment of patterns of mobile phone usage that corresponded to the ICD-10 criteria for substance dependence syndrome. The MPAS, with respect to mobile phone use, checked for presence of intense desire (Questions 1–6, 9), impaired control (Q. 1, 3, 4, 7, 9, 10–13, 19), withdrawal (Q. 14, 15), tolerance (Q. 10, 11, 19), decreased interest in alternate pleasures (Q. 8, 19), and harmful use (Q. 12–20). The response to each of the MPAS items were recorded as per a 6-point Likert scale with options being 1 (strongly disagree), 2 (disagree), 3 (weakly disagree), 4 (weakly agree), 5 (agree), and 6 (strongly agree).

Students were explained the reasons for conducting the study, written informed consent was taken from them,

and no personally identifiable information was collected during the study. At the end of data collection, health education was imparted to the students regarding the risks associated with mobile phone overuse, means of reducing such behavior, and when to seek help. Ethical approval for conducting the study was granted by the Institutional Ethics Committee of the medical college.

Statistical Analysis: Data were analyzed using IBM SPSS Version 17. Categorical data were reported in frequency and proportions and quantitative data as median and interquartile range. Chi-square test was used to find associations between categorical variables. A $P < 0.05$ was considered as statistically significant.

Cronbach's alpha and the Spearman–Brown split-half reliability coefficient were calculated to assess the reliability of MPAS. A principal component analysis (PCA) was run on the 20-item questionnaire for assessing its construct validity. The present dataset satisfied the PCA requirements in terms of the linear relationship between variables and adequacy of sample size.[19]

A two-stage cluster analysis was performed to identify groups of medical students who were homogeneous within themselves, but heterogeneous with each other, regarding their mobile phone addiction-like behaviors. Using log-likelihood distance measure, a two-cluster solution was retained. All the 20 items of the MPAS were used in the cluster analysis. A cluster of students who reported higher scores were identified to be showing mobile phone addiction whereas those with lower scores were not showing mobile phone addiction-like behavior.

RESULTS

A total of 450 students participated in the study. Sixty-two questionnaires that were found incomplete were excluded, so the final sample size was 388. The study sample comprised of 233 (60.1%) male and 155 (39.9%) female medical students. The mean (SD) age was 20.48 (±1.8) years with 132 (34%) students belonging to the adolescent age group (10–19 years). Smartphone use was reported by 363 (93.6%), feature phones by 14 (3.6%), and basic mobile phones by 11 (2.8%) students. Most students (87.1%) reported regularly using mobile Internet facility. The students reported their mobile phone usage to include, surfing the Internet 287 (74%), group messaging 256 (66.1%), and browsing social media networks 252 (64.8%). Compared to leisure activities, Internet browsing on mobile phones for academic purposes was low (46.6%). Inability to concentrate as a symptom, lasting for at least 3 days within the previous 6 months, was reported by 102 (26.4%) students.

The MPAS had a high level of internal consistency, as determined by a Cronbach's alpha of 0.90. The Spearman–Brown split-half reliability coefficient was also adequate (0.799).

PCA of the student responses to the MPAS was conducted. The suitability of PCA was assessed prior to analysis. Inspection of the correlation matrix showed that all variables had at least one correlation coefficient greater than 0.3. The overall Kaiser–Meyer–Olkin (KMO) measure was 0.914 with individual KMO measures all greater than 0.8, classifications of "marvellous" according to Kaiser. Bartlett's test of sphericity was statistically significant ($P < 0.0001$), indicating that the data were likely factorizable.

PCA revealed four components that had eigenvalues greater than 1 and that explained 36.1%, 8.7%, 6.9%, and 5.3% of the total variance, respectively. Visual inspection of the Scree plot also indicated that four components should be retained [Figure 1]. The four-component solution explained 57.2% of the total variance. The interpretation of the data was consistent with the mobile phone addiction-like behavior that the MPAS was designed to measure, with strong loadings of harmful use items on component 1, intense desire items on component 2, impaired control items on component 3, and tolerance items on component 4. Component loadings of the rotated solution are presented in Table 1.

The two-stage cluster analysis classified 155 (39.9%) students reporting higher MPAS scores into the cluster group showing mobile phone addiction whereas 233 (60.1%) students with lower MPAS scores were classified into the cluster group showing an absence of mobile phone addiction-like behavior.

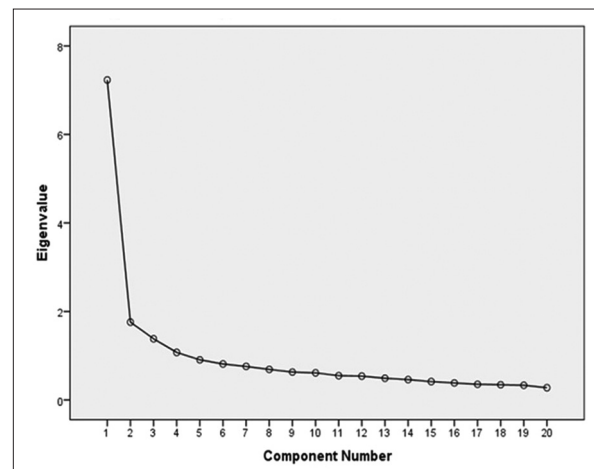The prevalence of behavior suggestive of mobile phone addiction was higher in older compared to adolescent

Figure 1: Scree plot of the mobile phone addiction questionnaire

students, but the difference was not statistically significant. No relationship was found between gender, residence, or frequency of mobile data use with mobile phone addiction-like behavior [Table 2].

Most important predictor for both the addiction and nonaddiction cluster groups were Q. 15 (Experience stress when not using your mobile phone), Q. 13 (Get annoyed or shout if someone asks you to decrease the use of mobile phone), Q. 12 (The people around you complain that you do not pay attention to them due to mobile phone use), Q. 18 (Feeling tired and lacking adequate sleep due to excessive mobile phone use), Q. 9 (Usually check your mobile phone even while engaged in group participation), and Q. 6 (Constantly check mobile phone so as not to miss conversations between my friends/other people on Twitter/Facebook/WhatsApp).

Student responses to the MPAS are reported as median and interquartile range, with higher median scores indicating a higher risk of addiction to mobile phone use [Table 3]. A median score of ≥4 was seen for questions Q. 1, 5, 10, and 11 reflecting impaired control, whereas a median score of 3 was seen for questions Q. 3, 4, 6, 7, 12, 18, and 19 reflecting presence of intense desire and harmful use associated with mobile phone usage.

Male students, compared to female students, were significantly more likely to report a loss of concentration due to mobile phone use and using their mobile phones impulsively in situations that potentially threatened their road safety. Older students also were significantly more likely to report agreement with items relating to intense desire and compulsive use of mobile phones while driving or crossing the road [Table 4].

DISCUSSION

The present study found most students used smartphones in an urban Indian medical college setting consisting of adolescent and youthful population. The utilization of mobile Internet facility for accessing social networking and engaging in group communication was also reported by most students. Mobile phone addiction was observed in nearly 40% of the subjects from medical undergraduate (MBBS) students at a medical college in Delhi.

A study from Kolkata by Dasgupta *et al*. reported nomophobia in 42.6% medical students assessed with the NMP-Q questionnaire.[7] Prasad *et al*. reported nomophobia in 24.7% dental students in Uttar Pradesh assessing with a self-designed questionnaire.[20] Nikhita *et al*. found mobile phone addiction present in 31.33% English medium secondary school students of Navi Mumbai assessed with a 23-item questionnaire developed by Aggarwal *et al*.[9] Methodological heterogeneity arising from the different questionnaires used for assessment of mobile phone addiction precludes an accurate comparison with our study findings. Nevertheless, a study in 2010 by Dixit *et al*. among medical students in the presmartphone period had reported mobile phone addiction in only 18.5% medical students, which suggests an increasing trend toward mobile phone addiction.[21]

In contradiction to previous studies by Yildirim *et al*.,[22] Sharma *et al*.,[6] and Nikhita *et al*.,[9] the present study did not find the female gender at a higher risk of mobile phone addiction. However, analysis of individual items

Table 1: Rotated structure matrix for PCA with varimax rotation of a 4-component mobile phone addiction scale

Items	Rotated component coefficients			
	Component 1	Component 2	Component 3	Component 4
Q. 14	**0.746**	0.184	0.169	0.038
Q. 17	**0.703**	0.077	0.088	0.159
Q. 15	**0.681**	0.227	0.382	−.053
Q. 18	**0.626**	0.188	0.310	0.178
Q. 13	**0.626**	0.146	0.443	0.006
Q. 19	**0.574**	0.179	−.074	0.312
Q. 16	**0.554**	0.033	0.336	0.274
Q. 20	**0.414**	0.404	0.159	−.264
Q. 3	0.104	**0.744**	0.226	0.116
Q. 4	0.171	**0.709**	0.262	−.117
Q. 5	0.167	**0.680**	−.143	0.258
Q. 1	0.043	**0.649**	0.179	0.373
Q. 2	0.229	**0.612**	0.209	0.001
Q. 6	0.151	**0.543**	0.463	0.192
Q. 7	0.162	0.220	**0.733**	0.080
Q. 8	0.204	0.106	**0.720**	0.136
Q. 9	0.290	0.329	**0.563**	0.081
Q. 12	0.444	0.162	**0.511**	0.179
Q. 11	0.179	0.041	0.168	**0.809**
Q. 10	0.209	0.294	0.187	**0.706**

PCA – Principal Component Analysis, Major loadings for each item are in bold

Table 2: Factors associated with mobile phone addiction-like behavior in medical students (*n*=388)

Variable	Mobile phone addiction		*P*
	Present (*n*=155)	Absent (*n*=233)	
Age (in years)			
≤19	45 (34)	87 (66)	0.10
≥20	110 (43)	146 (57)	
Gender			
Male	96 (41.2)	137 (59.8)	0.59
Female	59 (38)	96 (62)	
Residence			
Hostel	95 (41.5)	134 (48.5)	0.46
Family	60 (37.7)	99 (62.3)	
Mobile data use			
Regular	134 (39.6)	204 (60.4)	0.75
Sometimes/rarely	21 (42)	29 (58)	

Table 3: Distribution of responses to the mobile phone addiction scale in medical students (*n*=388)

Item	Question	Median	IQR
1	Usually check your Whatsapp/Facebook/SMS notifications as soon as you receive them during the day?	4	2
2	Usually check Whatsapp/FB/SMS notifications received while resting in light sleep?	2	3
3	Usually impulsively check for Whatsapp/FB/SMS notifications while attending classes or studying at home?	3	3
4	Usually check your mobile phone for messages/gaming/surfing while attending classes?	3	3
5	Usually check your mobile phone for new messages or notifications right after waking up from sleep?	5	2
6	Constantly check mobile phone so as not to miss conversations between my friends/other people on Twitter/FB/Whatsapp	3	2
7	Having a hard time concentrating in class, while doing assignments, or while working due to mobile use	3	3
8	Preferring talking with my smartphone buddies to hanging out with my real-life friends or with the other members of my family	2	3
9	Usually check your mobile phone even while engaged in group participation	2	3
10	Using your mobile phone longer than you had intended to	4	2
11	Always thinking that you should shorten your mobile phone usage	5	3
12	The people around you complain that you do not pay attention to them due to mobile phone use	3	3
13	Get annoyed or shout if someone asks you to decrease the use of mobile phone	2	3
14	Feeling impatient and fretful when you are not holding your mobile phone	2	3
15	Experience stress when not using your mobile phone	2	2
16	Experiencing lightheadedness or blurred vision due to excessive mobile phone use	2	3
17	Feeling pain in the wrists or at the back of the neck while using a mobile phone	2	3
18	Feeling tired and lacking adequate sleep due to excessive mobile phone use	3	3
19	Cannot imagine living without my mobile phone	3	4
20	Compulsively respond to calls or messages at places where it is dangerous to do so like driving or crossing the road	2	3

Table 4: Item agreement on the mobile phone addiction scale and association with age and gender among medical students (*n*=388)

Item	Agree	Gender		Age (in years)	
		Male (*n*=233) No. (%)	Female (*n*=155) No. (%)	≤19 (*n*=132) No. (%)	≥20 (*n*=236) No. (%)
1	275 (71)	167 (71.6)	108 (69.6)	93 (70.5)	182 (77.1)
2	138 (35.6)	83 (35.6)	55 (35.4)	35 (26.5)	103 (43.6)[†]
3	179 (46.1)	115 (49.3)	64 (41.3)	51 (38.6)	128 (54.2)[†]
4	154 (39.7)	93 (40)	61 (39.3)	44 (33.3)	110 (46.6)
5	263 (67.8)	157 (67.3)	106 (68.4)	78 (59)	185 (78.4)[†]
6	156 (40.2)	102 (43.7)	54 (34.8)	49 (37)	107 (45.3)
7	153 (39.4)	106 (45.5)	47 (30.3)*	49 (37)	104 (44)
8	114 (29.4)	69 (29.6)	45 (29)	35 (26.5)	79 (33.5)
9	109 (28.1)	72 (31)	37 (24)	39 (29.5)	70 (29.7)
10	264 (68)	157 (67.4)	107 (69)	91 (70)	173 (73.3)
11	271 (69.8)	155 (66.5)	116 (74.8)	98 (74.2)	173 (73.3)
12	155 (39.9)	95 (40.7)	60 (38.7)	54 (41)	101 (42.8)
13	111 (28.6)	65 (28)	46 (29.7)	36 (27.3)	75 (31.8)
14	142 (36.6)	82 (35.2)	60 (38.7)	48 (36.4)	94 (39.8)
15	96 (24.7)	56 (24)	40 (25.8)	25 (19)	71 (30)[†]
16	144 (37.1)	95 (40.8)	49 (31.6)	54 (41)	90 (38.1)
17	130 (33.5)	79 (34)	51 (33)	48 (36.4)	82 (34.7)
18	156 (40.2)	102 (43.7)	54 (34.8)	50 (37.8)	106 (45)
19	189 (48.7)	110 (47.2)	79 (51)	63 (47.8)	126 (53.4)
20	97 (25)	72 (31)	25 (16.1)*	23 (17.4)	74 (31.3)[†]

*$P<0.01$, [†]$P<0.05$

of the questionnaire showed that the male students were significantly more likely to report agreement with mobile phone usage during classes causing difficulty in concentration, along with impulsive mobile use undermining their road safety.

Previous studies have suggested that younger individuals are at a higher risk of developing addiction-like behavior from their mobile phone usage.[7,23] However, our findings are in disagreement as mobile phone addiction rates in the present study did not significantly differ between the adolescent and nonadolescent groups. Furthermore, students aged 18–19 years were found less likely to report agreement with items assessing intense desire or impaired control, compared to older students.

Worsening of sleep quality causing waking time tiredness has been observed with mobile phone overuse

tending toward addiction.[8,24] Our study found 40.2% students in agreement with the view that they felt and lacked adequate sleep due to excessive mobile phone use. Moreover, 35.2% students reported checking notifications from social media networks even while resting or in light sleep.

The strength of the present study is that it assessed mobile phone addiction-like behavior using a self-designed questionnaire that was appropriately assessed for reliability and validity. Moreover, the items in the questionnaire were localized and suited to the Indian context. The limitation of our study is that it was conducted in a single medical college in Delhi and caution needs to be exercised while generalizing the study findings.

In conclusion, a significant burden of mobile phone addiction and a tendency for impaired control that compromises the health and wellness were prevalent in medical students. Measures need to be taken to address this challenge in view of the current era of growing information technology. Future studies need to design and test interventions for addressing this evolving public health problem.

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Conflicts of interest
There are no conflicts of interest.

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