Study of Smartphone Addiction and Its Predictors among Medical College Students in Puducherry, South India

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Abstract Smartphones are mobile phones with advanced features over and above those of basic phones. Smart phone addiction has been an emerging problem in modern era. But the existing knowledge about excessive use of smartphone still remains insufficient. The objective was to determine the prevalence of smartphone addiction, its predictors and details on smartphone use among medical college students in Puducherry, South India. A cross sectional study involved 253 second and third year medical college students in a Government medical college in Puducherry, South India was carried out. Data were collected using a validated, pretested, structured, and self-administered questionnaire. Appropriate statistical methods such as descriptive statistics, mean and standard deviation were performed for demographic variables. Logistic regression analysis was done to determine demographic and health-related predictors of smartphone addiction. In this present study, the prevalence of smartphone addiction among medical students was 54.2%. Addiction to smart phone had influenced various effects on health such as physical, psychological and social effects. Independent factors such as usage of smart phone for more than two hours, avoiding daily tasks and duties, not being punctual in day-to-day activities were significantly associated with smart phone addiction. To conclude Smart phone as a self-learning tool is essential. But overuse results in addiction. Increased awareness and standardized

measures for identification of smart phone addiction and appropriate intervention for those in need of help might alleviate this problem.

Keywords Smart Phone Addiction, Internet Addiction, Medical Students

1. Introduction

Smartphones are mobile phones with advanced features over and above that of basic phones. According to Oxford dictionaries (2016) smart phone is defined as a "mobile phone that performs many of the computer's tasks. It usually has a touch screen interface, internet access and an operating system that can run various downloaded applications" [1].

Education, entertainment and information are few of the versatile mobile applications of smart phones in addition to communication. Therefore they are increasingly desired and have become indispensable in everyday life. They have become an increasingly important component of daily life because of its many advantages [2].

Also, smart phone involves four main criterion: irresistible mobile phone use; behaviours like frequent checking for various applications; tolerance and academic, functional or social withdrawal and impairment [3].

WHO defines addiction as, “dependence or continuous use of something for the sake of relief, comfort or stimulation which often causes cravings when it is absent” [4].

In the current modern era, smart phone addiction has been an emerging problem. It appears that many students are tending to be dependent more on their smartphones, which eventually leads to addiction [5]. The physical effects of smart phone use include neck pain, headache, dry eyes, refractive error, sleep disorders, obesity or avoidable accidents [6]. Smart phone overuse adversely affects the health due to over exposure to radio frequency waves, microwave and electromagnetic fields. Overindulgence of smart phone affects the brain's electrical activity, impairs cognitive function, alters sleep pattern and even causes irregularities in heart rate and blood pressure [7].

Youngsters, by using smart phones gained multitasking capacity and expanded social interaction but their learning capability has been significantly impaired. [8-11]. Though poor academic performance is the most worrisome effect of smart phone overuse, it also impairs the quality of life by causing mental stress, depression, reduced sleep time, impaired cognitive function which leads to dissatisfaction with life [12-15]. Younger generation, especially college going students, who are attracted towards exploring new technology are vulnerable for smart phone addiction [16].

Thus, it is essential to recognize students who are more likely to develop smartphone addiction. However, meagre knowledge is available about predictors of excessive smartphone use. This study provides insights into smartphone use and its addiction, its predictors among young medical students. With this background, the objectives of this study was to determine the prevalence of smart phone addiction and to identify the various factors associated with smartphone addiction among medical college students in Puducherry, South India.

2. Material and Methods

A descriptive cross sectional study involving undergraduate medical students in a Government medical college in Puducherry, South India. The study period was three months from July 2017 - September 2017. Second and third year medical college students having a smart phone and who were willing to participate and gave consent were included in the study.

The sample size was 250 calculated using the formula $n = 4pq/d^2$ taking the prevalence of 17% for smart phone addiction among college students, according to a previous study [17] at 95% confidence interval and a sample error of 5% and drop-out rate as 10%. A validated pretested structured self-administered questionnaire which included socio-demographic variables, Smartphone Addiction Scale (SAS) and effects on health among smartphone users was used to collect the data.

Smartphone addiction was assessed using a pre-designed and pre-tested questionnaire designed on the

lines of one developed by the Smart phone Addiction Scale (SAS) [18]. The questionnaire was modified according to the local conditions and settings. The Smart phone Addiction Scale (SAS) covers five areas namely, disturbance in daily life, withdrawal, cyberspace-oriented relationship, overuse and tolerance. The results of the SAS analysis showed a Cronbach's alpha of 0.967. Based on the cut-off values, SAS was considered appropriate for the assessment of smartphone addiction.

Further, questionnaire on effects of health among smartphone users include physical, psychological and social effects of health. The Institute Research Committee and Institute Ethics Committee approval was obtained. Written informed consent was obtained and confidentiality was ensured.

Data entry and analysis were done using MS Excel 2010 and SPSS Version 23 (SPSS, Chicago, IL) software respectively. Descriptive statistics, frequency, mean and standard deviation were estimated for demographic characteristics as appropriate. Chi-square test was used to find the association between attributes. A logistic regression analysis was done for determining demographic and health-related predictors of smartphone addiction.

3. Results

The study comprised 253 medical college students who were studying MBBS course and their mean age was 20.02 ± 1.07 years. Among the total participants 142(56.10%) of medical students belonged to 3rd year and the rest 111(43.9%) were studying 2nd year MBBS. Out of the 253 students, males represented 151(59.70%) and the remaining 102(40.30%) were females. The mean family income among the medical students studied was 544 U. S dollars. Out of the total 253 students surveyed, only 6(2.40%) and 5(2%) students were alcoholics and smokers respectively.

The occupation of fathers and mothers of medical students studied was based on classification by the Labour Bureau, Government of India [19]. A majority (69.2%) of them belonged to semiskilled workers like clerks, typists or drivers, 42(16.6%) were professionals and 33(13%) of them were unskilled workers.

Similarly, a majority (94.9%) of mothers belonged to the semiskilled category. Only 10(4%) of mothers were professionals and the remaining 1.2% were unskilled workers.

All 253(100%) of the medical students under the study owned a smart phone.

Table 1 shows that the overall prevalence of smart phone addiction among medical students. We used a standardized validated smart phone addiction scale to evaluate smart phone addiction. The total scoring was given and an average score above 50% was considered as smart phone addiction. According to this, the prevalence of smart phone addiction among students studying in medical college was found to be 54.2% (137/253).

Table 1. Prevalence of smart phone addiction among the medical students

S.no	Variables	Number	Percentages
1	Smart phone addiction present	137	54.2%
2	Smart phone addiction absent	116	45.8%
3	Total	253	100%

It was observed that 206(81.40%) used smart phone for more than 2 hours. 123(48.6%) of them charged their smart phones once a day. About 91(36%) charged their phone two times a day and the remaining 39(15.4%) charged more than two times a day. Data usage was observed to be more than 2 GB per month in 105(41.5%) of medical students.

Table 2 gives the purpose of smart phone used by the medical students. A majority (58.9%) used smart phones for social media, surfing, games and camera. 9.5% of the participants used smart phones only for communicating in social media. An equal proportion (9.5%) of them used it

for social media and surfing. Another 24(9.5%) used smart phone for social media, surfing and camera. About 4.4% of them used it for social media and playing games. 2% of medical students used it only for surfing.

Table 2. Purpose of smart phone use among the medical college students

S.no	Purpose of smart phone use	N*	Percentages
1	Social media, surfing, games, camera	149	58.9%
2	Social media, surfing	24	9.5%
3	Social media	24	9.5%
4	Social media, surfing, camera	24	9.5%
5	Social media, surfing, games	11	4.4%
6	Social media, games	10	3.9%
7	Surfing	5	2%
8	Others	8	3.1%

*Multiple responses (N = 255)

Table 3. Chi square analysis to find predictors of smartphone addiction among students

S. no	Variables	Sub category	Smartphone Addiction present N(%)	Smartphone addition absent N(%)	Total	Chi-square test	
						Chi-square value	p- value
1	Year	2 nd year	51(45.95%)	60(54.05%)	111	5.36	0.02*
		3 rd year	86(60.57%)	56(39.34%)	142		
2	Duration of smart phone use	≤ 2 hours	11(23.40%)	36(76.60%)	47	21.98	0.00*
		> 2 hours	126(61.17%)	80(38.83%)	206		
3	Eye problems	Present	58(72.5%)	22(27.5%)	80	15.87	0.00*
		Absent	79(45.67%)	94(54.33%)	173		
4	Decreased physical activity	Present	107(65.24%)	57(34.76%)	164	23.11	0.00*
		Absent	30(33.71%)	59(66.29%)	89		
5	Headache	Present	54(72.97%)	20(27.03%)	74	14.93	0.00*
		Absent	83(46.37)	96(53.63%)	179		
6	Neck pain	Present	42(65.62%)	22(34.38%)	64	4.54	0.03*
		Absent	95(50.26%)	94(49.74%)	189		
7	Strains	Present	52(0.65%)	28(0.35%)	80	5.55	0.01*
		Absent	85(49.13%)	88(50.87%)	173		
8	Sleep disturbances	Present	78(72.22%)	30(27.78%)	108	24.79	0.00*
		Absent	59(40.69%)	86(59.31%)	145		
9	Hear ringtone	Present	61(69.32%)	27(30.68%)	88	12.50	0.00*
		Absent	76(46.06%)	89(53.94%)	165		
10	Anger and restless	Present	84(65.12%)	45(34.88%)	129	12.75	0.00*
		Absent	53(42.74%)	71(57.26%)	124		
11	Lack motivation	Present	95(70.89%)	39(29.11%)	134	32.18	0.00*
		Absent	42(35.29%)	77(64.71%)	119		
12	Poor communication	Present	97(71.85%)	38(28.15%)	135	36.53	0.00*
		Absent	40(33.90%)	78(66.10%)	118		
13	Quarrels	Present	56(66.67%)	28(33.33%)	84	7.94	0.00*
		Absent	81(47.93%)	88(52.07%)	169		
14	Avoid tasks	Present	89(77.39%)	26(22.61%)	115	45.87	0.00*
		Absent	48(34.78%)	90(65.22%)	138		
15	Don't feel lonely	Present	89(61.38%)	56(38.62%)	145	7.15	0.00*
		Absent	48(44.44%)	60(55.56%)	108		
16	Not punctual	Present	64(81.01%)	15(18.99%)	79	33.39	0.00*
		Absent	73(41.95%)	101(58.05%)	174		
17	Responding to people	Present	63(63.64%)	36(36.36%)	99	5.89	0.01*
		Absent	74(48.05%)	80(51.95%)	154		

*p value <0.05 is significant

Table 3 shows the chi-square analysis to find the predictors of smart phone addiction among medical undergraduate students using a smart phone. From the socio-demographic variables, it was found that smart phone addiction was more among third year students compared to second years ($X^2 = 5.36$; $p = 0.02$). Medical college students who used the smart phone for more than 2 hours (61.17%) were significantly associated with smart phone addiction compared to 38.8% of remaining participants who used the smart phone for less than 2 hours ($X^2 = 21.97$; $p < 0.05$). Eye problems were more common among smart phone addicts (72.5%) as compared to students without addiction (27.5%) and was found to be statistically significant ($X^2 = 15.86$; $p < 0.05$). Headache was higher (72.97%) among participants with smart phone addiction compared to 27.03% of them without addiction. This difference was statistically significant ($X^2 = 14.92$; $p < 0.05$). 65.62% of medical students with smart phone addiction complained of neck pain compared to those without addiction (34.38%). This difference was statistically significant ($p < 0.05$). Also, the proportion of students who reported strains was significantly higher among those with smart phone addiction as compared to the ones without addiction (65% vs 35%). About 72.2% of participants with smart phone addiction complained of sleep disturbances compared to 27.78% without smart phone addiction. This difference was statistically significant ($X^2 = 24.78$; $p < 0.05$). 69.32% of medical students with smart phone addiction complained of hearing ringtones in its absence, which was significantly higher among students without addiction (30.68%). The proportion of medical students with smart phone addiction who reported anger, irritability and restlessness during unreachable network was significantly higher compared to students without addiction (65.12% vs 34.88%). Lack of motivation in studies was significantly higher among smart phone addicts (70.89%) compared to 29.11% without

smart phone addiction. This difference was statistically significant ($X^2 = 32.17$; $p < 0.05$). Looking at the social factors, the proportion of medical students with poor communication was significantly higher among the ones with smart phone addiction (71.85%) compared to those without addiction (28.15%). This difference was significant ($X^2 = 36.53$; $p < 0.05$). Quarrelling with siblings was significantly higher among students with smart phone addiction (66.67%) compared to 33.33% without smart phone addiction. 77.39% of medical students with smart phone addiction avoided daily tasks and duties compared to 22.61% without addiction. This difference was statistically significant ($X^2 = 45.86$; $p < 0.05$). Among the smart phone addicts, students who don't feel lonely when using the smart phone were significantly higher (61.38%) compared to ones without addiction (38.62%). It was observed that 81% of students with smart phone addiction reported as not being punctual in daily activities as compared to 18.99% without addiction. This difference was statistically significant ($p < 0.05$). Medical students with smart phone addiction who don't mind responding to people were 63.64% compared to students without addiction. This difference was also statistically significant ($p < 0.05$).

Table 4 gives the univariate analysis of the significant risk factors for smart phone addiction among medical college students. According to the Univariate logistic regression model, the factors associated significantly with use of smart phone was the duration of smart phone use, eye problems, decreased physical activity, headache, neck pain, strains, sleep disturbances, hearing the ringtone, anger, irritable and restless, lack of motivation to study, poor communication, quarrels, avoiding daily tasks, feels lonely, not punctual and responding while using smart phone. These significant risk factors were fitted in the logistic regression model to see the independent effect by controlling the confounders.

Table 4. Univariate analysis of risk factors of smartphone addiction among respondents

S. no	Variables	Responses	Smart phone addiction present	Smartphone addiction Absent	Sig	OR (95% CI)
1	Year	2 nd year	51	60	0.02*	1.80 (1.09-2.98)
		3 rd year	86	56		
2	Duration of smart phone use	≤ 2 hours	11	36	0.00*	5.15 (2.48-10.70)
		> 2 hours	126	80		
3	Eye problems	Present	58	22	0.00*	3.14 (1.77-5.57)
		Absent	79	94		
4	Decreased physical activity	Present	107	57	0.00*	3.69 (2.14-6.36)
		Absent	30	59		
5	Headache	Present	54	20	0.00*	3.12 (1.73-5.64)
		Absent	83	96		
6	Neck pain	Present	42	22	0.00*	1.89 (1.05-3.41)
		Absent	95	94		
7	Strains	Present	52	28	0.01*	1.92 (1.11-3.33)
		Absent	85	88		
8	Sleep disturbances	Present	78	30	0.00*	3.79 (2.22-6.48)
		Absent	59	86		
9	Hear ringtone	Present	61	27	0.00*	2.65 (1.53-4.57)
		Absent	76	89		
10	Anger and restless	Present	84	45	0.00*	2.50 (1.51-4.15)
		Absent	53	71		
11	Lack motivation	Present	95	39	0.00*	4.47 (2.63-7.58)
		Absent	42	77		
12	Poor communication	Present	97	38	0.00*	4.98 (2.92-8.49)
		Absent	40	78		
13	Quarrels	Present	56	28	0.00*	2.17 (1.26-3.75)
		Absent	81	88		
14	Avoid tasks	Present	89	26	0.00*	6.42 (3.67-11.24)
		Absent	48	90		
15	Lonely	Present	89	56	0.00*	1.99 (1.19-3.29)
		Absent	48	60		
16	Punctual	Present	64	15	0.00*	5.90 (3.12-11.17)
		Absent	73	101		
17	Response	Present	63	36	0.01*	1.89 (1.13-3.17)
		Absent	74	80		

*p value < 0.05 was considered significant

Table 5. Logistic regression model of predictors of smart phone addiction

S.no	Variables	B	SE	Wald	df	Sig	Exp(B)	95% CI
1	Year	0.37	0.32	1.32	1	0.24	1.45	0.76-2.77
2	Duration of smart phone use	1.08	0.45	5.54	1	0.01*	2.94	1.19-7.25
3	Eye problems	0.64	0.38	2.87	1	0.09	1.90	0.90-4.02
4	Decreased physical activity	0.32	0.39	0.66	1	0.41	1.37	0.64-2.96
5	Headache	0.30	0.40	0.55	1	0.45	1.35	0.61-2.99
6	Neck pain	-0.25	0.41	0.38	1	0.53	0.77	0.34-1.74
7	Strains	0.35	0.38	0.84	1	0.35	1.42	0.66-3.06
8	Sleep disturbances	0.34	0.35	0.93	1	0.33	1.41	0.70-2.84
9	Hear ringtone	0.57	0.35	2.62	1	0.10	1.77	0.88-3.56
10	Anger and restless	0.52	0.34	2.26	1	0.13	1.67	0.85-3.29
11	Lack motivation	0.46	0.34	1.79	1	0.18	1.59	0.80-3.14
12	Poor communication	0.55	0.36	2.24	1	0.13	1.72	0.84-3.53
13	Quarrels	0.08	0.35	0.06	1	0.80	1.09	0.54-2.19
14	Avoid tasks	0.93	0.37	6.28	1	0.01*	2.55	1.22-5.30
15	Lonely	0.17	0.34	0.26	1	0.61	1.19	0.60-2.36
16	Not Punctual	0.79	0.39	3.98	1	0.04*	2.21	1.01-4.83
17	Response	-0.07	0.35	0.04	1	0.83	0.92	0.46-1.85
	Constant	-3.31	0.57	33.51	1	0.00	0.03	

Table 5 shows the logistic regression model of risk factors for smart phone addiction among medical students. Duration of smart phone use, avoiding daily tasks and duties and not being punctual in daily activities was found to be significantly associated with the smart phone addiction. Medical students who use smart phone for more than 2 hours were at a higher risk of developing smart phone addiction (OR = 2.94, 95% CI = 1.19 - 7.25) compared to students who use them for a shorter duration (less than or equal to 2 hours). Medical students who avoid daily tasks and duties had 2.55 times the risk of developing smart phone addiction (OR = 2.55, 95% CI = 1.22 - 5.30). Not being punctual in day to day activities had a higher risk of developing smart phone addiction (OR = 1.69, 95% CI = 1.07 - 2.69).

4. Discussion

The purpose of this study was to determine the prevalence of smartphone addiction and to identify the various factors related to smartphone use. It was decided to conduct the study among young adults as they remain the target group of consumers for smartphone use. Smart phones are becoming almost inevitable in everyday life for most of the medical graduates, thereby increasing the risk of addiction during their adolescent or early adulthood period. Hence, this study was conducted among 253 undergraduate medical students in a Government medical college located at Puducherry, South India.

The prevalence of smart phone addiction was evaluated

using a standardized, pretested and validated Smart phone Addiction Scale (SAS) [18]. The prevalence of smartphone addiction quantified in this study was found to be 54.2% (137/253). This finding was similar to the study done among medical college students in Mansoura where the prevalence was 53.6% [20]. Similar findings were reported in the studies conducted by Dhamija S *et al* [21] in Maharashtra and by Awasthi S *et al* [22] in Uttarakhand. A study on nomophobic behaviours among smartphone users in West Bengal reported that the proportion of smart phone addiction among medical students was 42.6% [23]. Smart phone addiction among medical students in China was 39.7% [24]. Similarly, smartphone addiction was found 36.8% among medical students in Nepal [25]. A higher prevalence of 85.4% was reported in the study done by Sethuraman AR *et al* [26] in Andaman and by Okasha T *et al* in Egypt [27].

Whereas in a study conducted by the Swiss Research Institute for Public health smartphone addiction was 16.9% among young people in Switzerland [17]. The prevalence among British adolescents of age 11–14 was 10% [28]. The prevalence of addiction to internet was 4.9-10.7% in Korea and is viewed as a serious public health issue [29]. The prevalence of smart phone addiction among medical students in Assam was 28.6% [30]. In India, addiction is stated at 39-44% in this age group [31]. High smart phone addiction in the present study could be owing to the lack of other sources of outdoor activities. As medical students are preoccupied with heavy academic syllabus and they use smart phone as the only tool of entertainment to relieve their stress. In addition to that, they may have a constant

obsession to take selfie and post them on social media which is easily available in smart phone besides various applications of chatting, gaming and social media [26]. The differences in the prevalence among different studies may reflect the differences in methodology, assessment scales used, definitions of smart phone addiction and different population characteristics studied.

In the present study, the mean age of the participants was 20.02 ± 1.07 . Since the study was conducted among medical undergraduate students similar finding was observed in other studies also [20-22, 24-26]. Compared to older generations, younger generations are more prone towards using smart phones for their fascinating features other than communication, because they are more susceptible to change in fashion trends and styles [32].

The present study showed that out of total smart phone users, 59.7% were males and 40.3% were females. This result was consistent with the study done by Liu H et al [24] where 61.4% were males and 59.3% were females. In a study by Bisen et al, it was shown that male students are more inclined to smartphone addiction than female students [33].

In a study population, the mean family income of the parents was 544 U.S dollars. In the study by Ithnain N et al [34] mean family income was 946.63 U.S. Dollars among medical students.

Out of 253 students studied, 2.4% and 2% were alcoholics and smokers respectively. A study conducted in Switzerland revealed that smartphone addiction was not linked to the use of alcohol or tobacco [17]. This result was also consistent with the study done by Kwon and Kim et al that excessive smartphone use is not associated with tobacco or alcohol use [35].

In the present study majority (81.4%) of students used their smartphone more than 2 hours in a day. This finding was similar to a study by Ghosh P et al [30], Surwase K et al [36] and Krishnamurthy et al [37] where the average use of internet per day was 2-3 hours. However, in another study by Ithnain N et al [34] in Malaysia reported usage of more than 3 hours per day. Studies done by Lee et al [38] and Lin et al [39] demonstrated that frequent use of smart phone had a stronger association with smartphone addiction than the duration of use.

With regards to the purpose of smart phone use, 58.9% used it for social media, surfing and camera. 9.5% of the participants used it only for social media. An equal proportion (9.5%) of participants used the smart phone for social media and surfing. Rest of the participants used smart phone for interacting in social media, surfing and for using camera. Another study by Eldesokey S et al [20] observed medical students widely used smart phones for social interaction (66.8%), to watch news (43.7%), for academic activities (39.2%), playing games (28.5%), educational (22.4%) and for scientific purposes (21%). Another study by Ithnain N et al [34] reported smart phones were used for social networking sites (67%), calls/ SMS (23.8%), games/ application (4.4%) and information/

news (3.5%).

A similar finding was also observed by Ghosh P et al [30] where the most familiar functional use of smart phone was social networking (51.4%), making phone calls (21.4%) followed by gaming (5.7%), text messaging (5.7%) and listening music by 5.7% of the medicos.

In the present study, the independent risk factors for smart phone addiction among the medical students were the duration of smart phone use, students who avoid daily tasks and duties and not being punctual in day to day activities were significantly associated with smart phone addiction among medical students. One such study reported that higher proportion of smartphone addiction were associated with females, possessing smartphone for more than 2 years, using it daily for more than 4 hours and paying 2.62 U.S dollars and above as monthly bills [23]. The study conducted by Eldesokey S [20] observed that independent predictors of smart phone addiction were studying less than or equal to 4 hours, mild/ moderate depression, severe/ extreme severe depression and severe/ extreme severe stress. Liu H et al [24] reported four factors i.e., professional identity, poor mental health, smart phone use before bedtime and study pressure were independent risk factors of smart phone addiction among medical students. Another research by Karki S et al [25] reported the prime predictors of smartphone addiction among medical students were male gender, overuse and self-acceptance addiction. The study conducted by Haug S et al in Switzerland found that smartphone addiction was more prevalent in young adolescents group of 15-16 years of age, students whose parents were both born abroad, those with less physical activity and more stress [17]. Also, a study conducted in Korea revealed that high-risk smartphone users had less physical activity. Moreover, the time of smartphone use was in proportional relationship with smartphone addiction [40].

5. Conclusion

In the present study the prevalence of smartphone addiction among medical students was 54.2%. Addiction to smartphone had influenced various effects on health such as physical, psychological and social effects. Independent factors such as usage of smart phone for more than two hours, avoiding daily tasks and duties, not being punctual in day-to-day activities were significantly associated with smart phone addiction.

Smart phones as a self-learning tool are essential. But their benefits lead to excessive use thereby resulting in addiction. Increased awareness is needed among the medical college students regarding smart phone addiction and its effects.

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