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Adverse Health Effects of Smart Phone Addiction and Nomophobia Among The Adolescents

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ABSTRACT
The addiction of smart phone has resulted in a new psychological entity known as nomophobia. The smart phone addiction in young adolescents of India was found to be similar to that of western country adolescents. To study the adverse health effects of smart phone usage and its addiction on the mental health of young adolescents and to create awareness among the young adults. The study is a cross sectional study done on 200 healthy volunteers of 18 to 26 years (100 males and 100 females) young adults with no prior history of any mental health disorder. A separate structured validated questionnaire about cell phone usage along was given to the participants after completing the NMP-Q survey. 19 Depending on the level of scoring in NMP-Q survey, the nomophobia was interpreted and participants were separated into 4 groups. Group A – absence of nomophobia was kept as control, Group B – mild nomophobia and Group C – moderate nomophobia was given awareness about the adverse health effect of smart phone addiction. The participants of group B & C was followed up regularly. The data was collected and analyzed by one way ANOVA nd Tukey HSD Post-HoC pairwise comparison. In the present study the prevalence of smart phone addiction was found to be 24%. The usage of smart phones for talking was the maximum (37.9%), surfing in net (25.8%), texting (19.7%) and the least usage was office related works (16.7%). The duration of smart phone usage for texting, talking and entertainment was analysed by one way ANOVA and was found to be highly statistically significant The study will help quite a lot of young adults to come out of the above addiction if they are aware of the adverse health effects. This study takes a look at some of the adverse psychological health effects and potential problems arising from the use of smart phones.
Keywords: Adverse health effects, Smart Phone Usage, Nomophobia, addiction, Psychological effects.

INTRODUCTION
Advancement in science and technology has made many gadgets, a smartphone is one of them [1]. Mobile phones were primarily used for communication purposes only in earlier days. However, over time, they have been redesigned to include advanced features that enhance user experience and convenience and offer entertainment. Thus, smartphones have become an integral part of our daily lives [2]. Present-day adolescents spend a lot of their time on their smart phones. People, particularly youngsters squander their time more likely on scrolling, typing on gadgets for academic activities, relaxation and entertainment purposes. Nomophobia is considered to be a modern phobia of the digital age and it is related to the problematic use of mobile technologies [3] and addiction problems [4]. Smartphone addiction is characterized by the excessive use of a smartphone and the expression of an uncontrollable desire to use it when it is out of one's sight or reach [5],[6]. However, some individuals find it difficult to control their smartphone use and become dependent on these devices As a result, they find it difficult to refrain from using their smartphones [7]. Further, when they are away from their smart phones, they experience anxiety. This phenomenon is called nomophobia (NOMObile PHOne is away from his or her smartphone) and the fear that results from being unable to use one's smartphone [8]. This causes an imbalance of time allocated to different activities in their lives [9].
Nowadays, adolescents find it difficult without using their smart phones in their daily routine life. Losing a mobile phone or Wi-Fi connection can be distressing to anyone, anxiety that is experienced when one

loses errand check notifications from social networking sites (SNSs). Which influence the adolescent lifestyle profiles (ALPs). The prevalence of nomophobia and smart phone addiction problem is now increasing globally [10]. The term Nomophobia is a psychological condition which is a kind of anxiety disorder and described in the DSM-IV, as a "phobia for a specific things". Various psychological factors such as low self-esteem, extrovert personality are recorded when a person overuses the mobile phone. The various signs and symptoms includes depression, anxiety, respiratory alterations, disorientation, trembling, agitation, perspiration, and tachycardia [11]. Significant predictors of ALPs includes both nomophobia and smartphone addiction. In addition, [12] nomophobia and smartphone addiction cannot be considered as unrelated disorders as both share the same symptoms [13],[14] and comorbid disorders such as obsessive-compulsive disorder, social phobia and depression [15]. Nomophobia may also act as a proxy to other disorders. Mobile phone addiction can be mentioned as one of the most important social problems caused by excessive use of mobile phones. Griffiths describes technological addiction as a behavioral and non-chemical addiction that is created by interaction with device. The positive life perspective and interpersonal relationship were negatively related to smart phone addiction [16]. Considering the importance of mobile phone addiction and the lack of studies on the relationship between addiction to mobile phone and sense of loneliness among the youngsters, this study was done. To study the adverse health effects of smart phone usage and its addiction on the mental health of young adolescents and to create awareness among the young adults.

MATERIAL AND METHODS
The study is a cross sectional study. Simple observations were made, based on a single examination of a cross-section of a population by administering a pre-tested questionnaire at one point in time. The study was conducted in Central Research Laboratory for Biomedical Research of VMKV Medical College & Hospitals, Salem after obtaining Human Ethical Committee approval (VMKVMCH/IEC/20/45). Consent was obtained from all the study participants. The study was done on 200 healthy volunteers of 18 to 26 years (100 males and 100 females) young adults with no prior history of any mental health disorder [17]. The confidentiality of the study participants was maintained throughout the study including the time period of cognitive behavioural therapy.

Nomophobia Questionnaire (NMP-Q):
The NMP-Q has 20 questions, each scored on a 7-point Likert scale. The total score on the NMP-Q is 20 at its lowest (20*1) or 140 (7*20) at its highest [18].

SCORE	INTERPRETATION
20	Absence of nomophobia in participants
21-59	Mild level of nomophobia in participants
60-99	Moderate level of nomophobia in participants
100-140	Severe nomophobia in participants

Data Collection Procedure:
A separate structured validated questionnaire (copyrighted by author) about cell phone usage along with the adverse health effects such as lack of sleep and concentration, stress, anxiety depression, irritability etc., was given to the participants to collect all the necessary basic information after completing the NMP-Q survey [19] Depending on the level of scoring in NMP-Q survey, the nomophobia was interpreted and participants were separated into 4 groups. Group A – absence of nomophobia was kept as control, Group B – mild nomophobia and Group C – moderate nomophobia was given awareness about the adverse health effect of smart phone addiction through a detailed power presentation session as an awareness program by the author (Psychologist) and remedial measure was taught to them to de-addict themselves from nomophobia. After the awareness program a post session survey was taken from all the participants about the benefit of awareness program and their midset with future plan of preventing themselves from smart phone addiction. Group D – severe nomophobia was given an awareness session along with group B & C and then they were taken to psychologist for cognitive behavioural therapy (CBT) (results under process). The participants of group B & C was followed up regularly. The data was collected and analyzed.

RESULTS
The current study was designed to bring out awareness among the young adults and a remedial solution for smartphone addiction and nomophobia. The data collected through questionnaire was analysed mean, proportion and range was calculated and tabulated the other parameters were analysed using one way

ANOVA nd Tukey HSD Post-HoC pairwise comparison. Table 1 gives the SAR value (Specific Absorption Rate) of the smart phones used by the participants which was shown to be within the normal range (SAR level of 1.6 W/Kg for body or below was safe).

Table 1: Participants age & SAR Value of smart phones

	Scoring in NMP-Q survey	SAR Value W/Kg	Participants Age
Mean	84.674	1.12	13.84
SD	31.05	0.429	3.40
Range	155	1.667	11
Minimum	20	0.04	8
Maximum	140	1.707	19

Figure 1: Participants reason for purchasing the smart phones
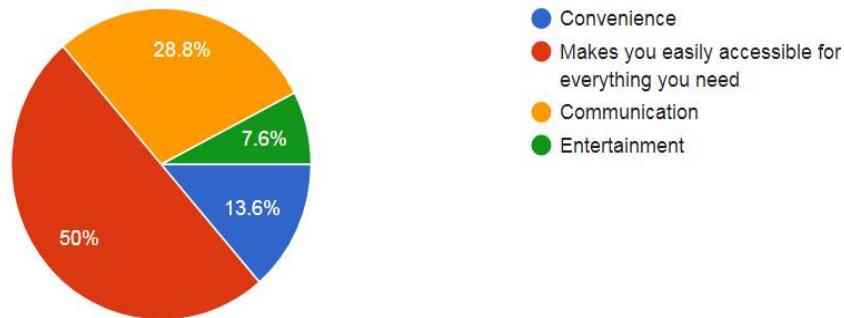
The various reasons for purchasing smart phones by participants include convenience, accessible, communication and entertainment (Figure 1). The usage of smart phones for talking was the maximum (37.9%), surfing in net (25.8%), texting (19.7%) and the least usage was office related works (16.7%) (Figure 2).
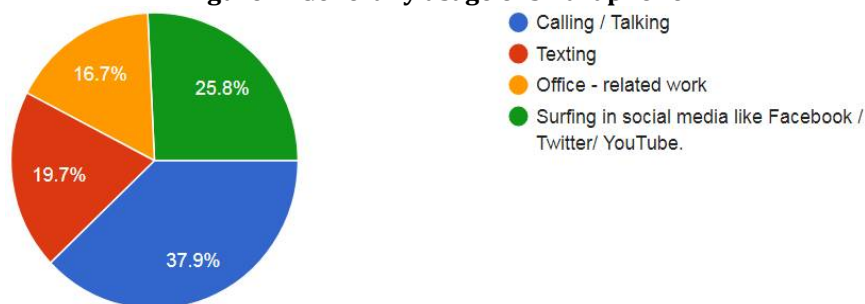
Figure 2: Generally usage of smart phone

Table 2: Smart phone usage by participants

S.No.	Smart phone usage by participants		Percentage
1.	Attending phone calls	Attend all calls	50%
		Attend selective calls	50%
2.	Smart Phone switch off at night	Yes	47%
		No	53%
3.	Phone on 'silent / vibration mode'	Always	34.8%
		Rare	62.1%
		Never	3.1%
4.	Phone with you while exercising / driving / shopping?	Yes	83.3%
		No	16.7%
5.	Play games on phone	Yes	31.8%
		No	68.2%
6.	Use of Headsets	Wired	47%
		Bluetooth	53%
7.	Side mostly used to talk in smart phone	Right	80.3%
		Left	19.7%
8.	Hand used for holding the smart phone	Right	78.8%
		Left	21.2%
9.	Carrying the Smart phone	Pockets	48.4%
		Bags / gadgets	25.8%
		Hand Pouches	25.8%

Table 2 shows the parameters of smart phone usage like mode of usage, headsets usage and side preferred for talking and holding, methods of carrying the smart phones. Various purposes of smart phone usage like texting, gaming, calling, mails, listening songs, taking pictures are shown in figure 3. The other purposes of usage includes work and entertainment, studies related, social media, online class, YouTube, netflix, music, reading, editing and videography.
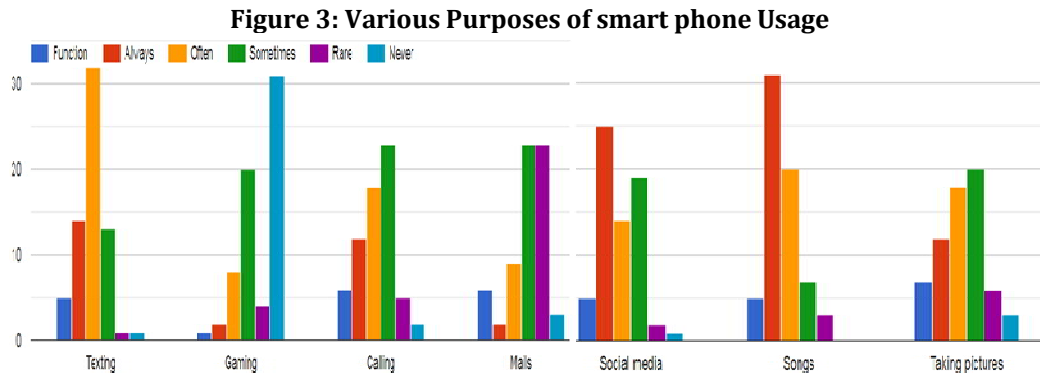
Figure 3: Various Purposes of smart phone Usage

The duration of smart phone usage for texting, talking and entertainment was analysed by one way ANOVA and was found to be highly statistically significant (P value 0.0001) (Table 3). The Tukey HSD Post-HoC pairwise comparison was used to analyse the usage and found to be significant for Texting vs Talking and Talking vs Entertainments but not significant for Texting vs Entertainments (Table 4)

Table 3: Duration of Smart phone usage by participants

S.No.	Normal usage of Smart phone per day (Minutes)	Mean±SD
1.	Texting	185.32±127.01
2.	Talking	105.6±101.10
3.	Entertainments	163.06±106.27
4.	Total time spent	375±210.6
5.	Work time usage	209.25±170.58

Table 4: Tukey HSD Post-HoC pairwise comparison

S.No.	Pairwise Comparison	P value
1.	Texting vs Talking	0.0001
2.	Texting vs Entertainments	0.1159
3.	Talking vs Entertainments	0.0001

When the participants was questioned that whether they can live without smart phone for a day, around 77.3% said yes can survive whereas 22.7% people said that they cannot live. When they were asked for reasons the following were stated "I must get updated, It's been a part, Now generation everything is a phone that's why, I want to make sure that people, especially family and friends can contact me if needed and also I have online class and every information is for that is shared through WhatsApp"

Adverse health effects and its associated symptoms:

Visual disturbances:
It includes eye pain, staining of eyes, myopia, eye sight problem, eyes burn, eye problem like irritation, dryness of eyes and headache.

Auditory disturbances:
It includes headache at times due to more noise, ear pain due to headphones, ear stuffing.

Psychological disturbances:
The participants felt the following disturbances of a feel as if going to lose vision after using mobile for long time, head ache, addicted, ringing, distracts a lot, lack of sleep.

Other associated symptoms on prolong usage:
Headache, eye pain etc.., hand pain, visual defect, irritation in eyes sometime and inability to sleep.

DISCUSSION

As per the earlier studies review done by Sahu *et al.*, [20], in India, the prevalence of mobile phone addiction ranges from 6% to 49%. The review stated the various problematic issues of smart phone usage which was associated with feeling insecure, late night sleep, parent-child relationships affected, pathological gambling, depression, tension and anxiety, hyperactivity, and emotional symptoms. In a study, smart phone dependence was found in 31% of students from 8th to 10th grade (Sample N=415) [21] In the study, smart phone dependence was associated with gender, type of smart phone used, average time duration spent per day on the smart phone and years of usage. Higher range of smart phone dependence was reported in a systematic review and meta-analysis on Indian adolescents (39-44% in a sample group of 1304) [22]. Various meta-analysis stated that Smartphone addiction could lead to negative health risks and dysfunctional interpersonal skills. In another study the phubbing phenomenon in a sample of adolescents from India (sample N=400), the prevalence was found to be 49% [23]. In the present study the prevalence of smart phone addiction was found to be 24% (Table 5).

Table 5: Prevalence of smart phones addiction in adolescents of various countries

Country	Prevalence
Turkey [24],[25]	51%
	89%
Great Britain [26]	10%
Barcelona [27]	2%
Switzerland [28]	17%
Rome [29]	26%
South Korea [30],[31],[32],[33]	14%
	31%
	15% for boys, 24% for girls
	32%
Taiwan [34]	21%
Japan [35]	23% for boys, 44% for girls
India [20],[21],[22]	6-49%
	39-44%
	31%
Present study	24%

Gender differences

Gender differences were also reported on the prevalence of smart phone addiction in adolescent age group of people [36]. A study from Taiwan reported that adolescent females had shown a greater smartphone dependence when compared to that of adolescent males [37]. In another study conducted in Japan on a sample of high school students (sample N=195), female were found to spend more hours a day on smart phones than that of males [35]. The survey reports that 42% of females and 23% of males spent 3 hours a day on smart phones on an average. Gender differences also emerged on the purpose of smart phone usage. Females usually spend longer duration on social networking sites, Internet browsing, and online chat whereas males spend more time on playing games.

Internet addiction and gaming:

The frequent usage of internet and smart phone gaming have been an important variable of smart phone addictions in adolescents. A study from Japan reported that females use their smart phones for social networking whereas males used their smart phones for gaming via the internet [38]. Usually the Smartphone Addiction Scale scores were found to be higher in females. In another study scores on the Internet Addiction Test were found to be a predictive factor of smartphone addiction [39],[40]. Smart phone gaming usually resulted in smart phone addiction [41]. In the present study the usage of smart phones for talking was the maximum (37.9%), surfing in net (25.8%), texting (19.7%) and the least usage was office related works (16.7%) (Figure 2).

Adverse health effects and its associated symptoms:

Reinecke et al. (42) had investigated psychological health effects and stimulator of digital stress. He had reported that communication load was positively related to perceived stress and had an indirect impact on depression and anxiety too. Another study was investigated whether anxiety and depression

independently contributed to smart phone addictions in a sample of 668 students and proposed that depression and anxiety were also a positive predictor of smart phone addiction [43]. Researchers found an intensive increase of smart phone usage among teenagers and the symptoms of depression, suicide risk factors and suicide rate. Smart phone addiction is negatively correlated with academic performance [44],[45].

Negi and Godiyal (2016) survey reported that there were correlation of negative psychological effects of smartphone usage on the young generations who were under depression and anxious while using their smart phones [46]. Another study investigated the addiction to the internet and personality traits and found that loyalty, emotional stability, and extroversion were the major predictors of internet addiction [47]. Thomée et al. (2011) had concluded that high smart phone usage was associated with sleep deprivation and symptoms of depression in both men and women [48]. A study on Malaysian population stated that frequent smart phone usage may lead to physiological and psychological complications [49]. A descriptive research suggested that internet addiction is similar to that of drug addiction except behavioral addiction (internet addiction) doesn't involve a substance. Another observational study reports that insomnia may lead to depression. Li et al. (2016) reported that insomnia and risk of depression are associated [50]. The smart phone usage had been associated with sleep deficit, depression, anxiety, and stress [51].

A researcher stated that teenagers who spend more hours on their smart phones likely having more risk of suicide. Other associated symptoms includes low emotional stability, chronic stress, and depression [52].

In the present study the Visual disturbances includes eye pain, staining of eyes, myopia, eye sight problem, eyes burn, eye problem like irritation, dryness of eyes and headache. Auditory disturbances includes headache at times due to more noise, ear pain due to headphones, ear stuffing. Psychological disturbances of a feel as if going to lose vision after using mobile for long time, head ache, addicted, ringing, distracts a lot, lack of sleep. Other associated symptoms on prolong usage includes headache, eye pain etc.., hand pain, visual defect, irritation in eyes sometime and inability to sleep.

CONCLUSION

The current study was designed to bring out awareness among the young adults of smartphone addiction and nomophobia. The study will help quite a lot of young adults to come out of the above addiction if they are aware of the adverse health effects. This study takes a look at some of the adverse psychological health effects and potential problems arising from the use of smart phones. It also helps to associate the knowledge and attitude of young adults regarding preventing of mental health complication on smart phone addiction. The study will be further extended with CBT treatment modalities through psychologist which will help the young adults suffering from cell phone addition and nomophobia to revert back to normalcy.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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