Research article

Nomophobia and the psycho-physiological effects of PUBG gaming on medical college student’s health and academic performance

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ABSTRACT

Introduction and Aim: Nomophobia is a psychological condition, where people have a fear of being detached from mobile phone connectivity. The medical college students are suffering from PUBG addiction which affects their psycho-physiological parameters. The aim is to assess the prevalence of nomophobia in the medical college students, to assess the stress and anxiety in the absence of smartphone and correlate it with the conduction velocity of median nerve.

Materials and Methods: A cross-sectional study was conducted in the physiology department of a tertiary care teaching hospital for a period of 2 months involving 169 medical students using smartphones. For studying nomophobia, the students in the study group were divided into groups A and B according to their smartphone usage and on the basis of a Smartphone Addiction Scale (SPAS) Questionnaire.

Results: Out of the 169 students, 80 were subjected for the assessment of the variability in the median nerve conduction velocity as a quantitative measurement to detect the decrease in the terminal latency index, motor distal latency and the conduction velocity due to excessive gaming or chronic smartphone usage. As per our hypothesis 94.37 % of the study sample had decreased terminal latency index and about 85.62 % of students had a decreased nerve conduction velocity.

Conclusion: The prevalence of nomophobia in our study was 37.39 % as per the ICD-10 diagnostic criteria for dependence syndrome. Hence medical education to school-going children, teenagers and adolescents about the risks of excessive smartphone usage should be given as they are the most vulnerable to this disorder.

Keywords: Nerve conduction; nomophobia; PUBG gaming; smartphone; stress.

INTRODUCTION

Smartphones have become the most-dependable type of relationship to mankind (1). A smartphone user is defined as the person using a smartphone at least once a month. According to the global mobile market report (2) which is based upon a country’s progression of economics, demography, population and inequality, India stands second with a total number of 34,59,16,000 smartphone users.

A previous study suggests that the average smartphone user checks their device 47 times a day/17,1.55 a year, while 85% of them will check it when speaking with family or friends. 80% of them check their phone within 1 hour after waking or before going to sleep. 47% of smartphone users have tried to limit the usage of phones in the past but only 30% of them were successful(3). Young students are the most prolific users of most services. Digital entertainment is the most popular usage for the age group per second is expected to gain more traction in the coming days(4).

The number of smartphone users in India is estimated to reach 299.24 million in 2017, whereas the number of smartphone users exceeds 2.3 billion users in the world by that time (5). Nomophobia means a psychological condition when people have a fear of being detached from mobile phone connectivity. Recently, there is a transformation of the cell phone from a status symbol to a necessity because it provides facilities like personal diary, email dispatcher, calculator, video game player, camera and music player (6). United Kingdom (UK) Post Office in 2008 coined the term, “nomophobia” during a study commissioned by YouGov, a UK-based research organization.

The symptoms like headache, stress, sleep disturbances and depression (7) and other physical constraints such as earache, headache, thumb ache, dizziness, eye-strain are associated with excessive mobile phone use(8). The researchers suggested that if caudate nucleus is used more, the hippocampus will be used less, causing it to lose cells (9).

Nomophobia is found to affect the mental status of the smartphone users and it has been included in the DSM-V (Diagnostic and Statistical manual of Mental disorders, fifth version) which is the gold standard manual for assessment of psychiatric diseases. Also,

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Biomedicine- Vol. 42 No. 3: 2022

567
using the six criteria for ICD-10 dependence syndrome, assessment of nomophobia has also been previously tried in several other studies like that of Dongre et al., (10). Nomophobia is also said to be the ‘Disorder of the 21st century’ (11).

Our study was primarily intended to determine the prevalence of nomophobia among our medical college students, categorizing them into two groups, the first being nomophobes and the second group comprises of students who are at the risk of developing nomophobia considering the magnanimous increase in the levels of smartphone usage for various activities by school and college going students (4) and the associated adverse effects that the students are suffering from. Also, to estimate the level PUBG addiction that our medical college students are suffering from by evaluating the number of hours they spend on gaming and by assessing how it affects the psycho-physiological variables in them. In the present study the investigator intended to assess the prevalence of nomophobia in the medical college students, to assess the psycho-physiological variables like amount of stress, anxiety in the absence of a smartphone, to assess anthropometric measurements like blood-pressure, height and weight of the students playing violent shooting games like PUBG and correlate it with the variability in their median nerve conduction velocity based on the chronicity of their smartphone usage and to determine the prevalence of students who suffer from deleterious effects of chronic mobile phone usage.

MATERIAL AND METHODS

A cross-sectional study was conducted amongst the undergraduate medical students.
- Study population : 19-22 years (I and II year M.B.B.S students)
- Study area : Physiology Department of a Tertiary Care Teaching Hospital
- Sampling method: Stratified Random Sampling Technique
- Sample size : 172 M.B.B.S students (both I & II year M.B.B.S. falling under the inclusion criteria)
- Study period : 2 months

Taking the prevalence (p) to be 68.92 % (12), using the formula 4pq/d² the sample size: 

\[
\frac{4 \times 68.92 \times 31.08}{8 \times 8} = 134
\]

(p = 68.92 % ; q = 31.08 % ; d = 8). Assuming 13 % of non-compliance, the final sample was chosen as 172 medical students. These students were administered a questionnaire to assess smartphone addiction and were categorized into 2 groups based on its analysis.

Group A: Nomophobes (who fulfil three or more criteria amongst the six criteria for dependence syndrome)
Group B: Risk of nomophobia

For the assessment of median nerve conduction velocity, taking the prevalence (p) to be 28.4% from other studies, and q being (100-p), using the formula 4pq/d².

Therefore, Sample size = \[
\frac{4 \times 28.4 \times 71.6 \times 67}{11 \times 11} = 67
\]

(p = 28.4 % ; q = 71.6 %; d = 11). Assuming 12 % non-compliance, the final sample was chosen as 80 medical students for the assessment of the variability, in the velocity of conduction of the median nerve, caused by the hazards of playing violent shooting games like PUBG.

Selection criteria

Inclusion criteria:
M.B.B.S. students of both genders between the age 19-22 years. Students who owned a smartphone and willing to volunteer in the study.

Exclusion criteria:
M.B.B.S. students who are below and above the given age range and students who do not own a smartphone.

Approval from the Institutional Research and Ethics committees was obtained before the commencement of the study (SRC: SVMC/SRC/2019/12/CTR385 dated 14.02.2019 and IEC: SVMCH/IEC/2019-Feb/7 dated 20.03.2019).

Data selection

The clearance was obtained from the Institutional Ethics Committee (IEC) before the commencement of the study. An ID code was assigned for the participants to maintain confidentiality of the data obtained. The willing participants were asked to provide the informed consent and the demographic details and smartphone usage details were obtained from 169 M.B.B.S students and a cross-sectional study was conducted on them (Out of the remaining three students, one did not own a smartphone and was under the age of 19 years and the other two were above 22 years of age). Based on the results of the questionnaire, 80 medical students were selected for the median nerve conduction velocity assessment for whom anthropometric measurements like height, weight and blood pressure and the velocity of conduction of the median nerve were recorded.

Subjective evaluation

Smartphone addiction was determined by using a pre-tested self-administered self-designed Smart Phone Addiction Scale (SPAS), which was designed based on a literature search and includes the questions from other validated questionnaires. The items mentioned in SPAS are designed for assessment of smart phone usage patterns which corresponds to the ICD-10 criteria for substance dependence syndrome. With respect to smart phone use, the SPAS was checked for
presence of intense desire, impaired control, withdrawal, tolerance, decreased interest in alternate pleasures and harmful use. The response to each of the SPAS items was 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).

The questionnaire was divided into three parts:

a) Demographic details of the participant: Gender, age, academic year, mobile phone type used (smartphone or simple type phone) and the age at which they started using their phones.

b) Anxiety associated with absence of smartphone usage consisting of 12 questions.

c) Attitude towards smartphone usage consisting of 22 questions.

The questionnaire consisted of total 34 questions based on the six indicators of substance dependence syndrome of ICD - 10 criteria and has twelve elements:

a. Response on near completion of mobile data or balance shortage in mobile.

b. Response of not being connected with social media due to non-use of phone or any of its functions.

c. Response for not using the phone for a day.

d. Time period of having mobile phone with self.

e. Tension due to non-timely response in the form of anxiety and stress.

f. Loss of mobile and battery discharge.

g. Response seen due to phone ringing at inappropriate time.

h. Spending time >3 hours per day on phone calls.

i. Tension in the form of anger or restlessness whenever someone tries to seize phone.

j. Feeling of agitation when someone advices to stop using our mobile phone.

k. Ringxiety.

l. Economic burden over the family.

Each question was made mandatory to be answered. The subjects were requested to read the questions carefully and answer honestly and assured of absolute confidentiality of information provided.

For determination of prevalence of nomophobia –

i. Group A – Nomophobes (who fulfil three or more criteria amongst the six criteria for dependence syndrome (13).

ii. Group B – Risk of Nomophobia.

The amount of stress and anxiety were determined using the Perceived Stress Scale Questionnaire.

**Objective evaluation**

The conduction velocity of median nerve was performed on both hands of the body in an environment with room temperature from 23°C to 25°C using Neurostim, Medicaid Systems, Chandigarh by using surface electrodes. The supramaximal stimuli was given first at the wrist then at elbow to obtain compound muscle action potential (CMAP) using stimulating electrodes. The distance between wrist and elbow was measured. The recording (active) electrode was placed close to the motor point of Abductor Pollicis Brevis muscle and reference electrode 3 cm distal to the active electrode at first metacarpophalangeal joint. The ground electrode was placed between stimulating and recording electrodes. Motor distal latency (MDL) and Conduction Velocity (CV) were measured from which the motor Terminal Latency Index (mTLI) was calculated.

The study subjects were also subjected to assessment of variability in the median nerve conduction velocity and grouped as Group 1: Less than normal velocity; Group 2: Normal velocity and Group 3: More than normal velocity.

**Data analysis**

All of the data collected was entered in MS Excel Sheets and the results of the study were statistically analysed using SPSS v. 22.

**RESULTS**

The study was done in 169 smartphone using medical students from I and II year M.B.B.S. out of which 80 were males and 89 were females (Fig.1).

The prevalence of nomophobia in the present study was 37.39% (n = 63) as per Criteria for substance use dependence in ICD-10. Overall 37.39% of the participants met three or more of the criteria for substance use dependence in ICD-10 (Table 1).

35 females (39.30%) had developed nomophobia as compared to 28 males (35.70%). As shown in Fig. 2, the proportion of the study sample who were at the risk of developing nomophobia was 43.33 % (n =46) out of which 23 (46%) were males as compared to 23 (41%) females.
Table 1: Distribution of subjects fulfilling criteria for substance use dependence in ICD-10

<table>
<thead>
<tr>
<th>Criteria for substance use dependence in ICD-10</th>
<th>Proportion of study sample under each criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Intense desire</td>
<td>39.64</td>
</tr>
<tr>
<td>b. Impaired control</td>
<td>37.57</td>
</tr>
<tr>
<td>c. Withdrawal</td>
<td>38.65</td>
</tr>
<tr>
<td>d. Tolerance</td>
<td>39.05</td>
</tr>
<tr>
<td>e. Decreased pleasure</td>
<td>34.48</td>
</tr>
<tr>
<td>f. Harmful use</td>
<td>35.20</td>
</tr>
</tbody>
</table>

**Fig 2**: Proportion of study sample who are nomophobic and are at risk of developing nomophobia

Therefore, Group A – Nomophobia (n = 63)
Group B – Risk of nomophobia (n = 46)

Amongst the criteria for ICD – 10 dependence syndrome the most commonly fulfilled criterion was intense desire (39.64 %) followed by, tolerance (39.05 %) and decreased pleasure (34.48 %). About 57.5 % of males and 41.57% of females pick up their smartphones and check it out on a false perception of ring or vibration (also known as RINGXIETY).

As shown in Fig: 3, 40.44% of females and about 53.75% of males use their smartphones at least 35 times a day.64.04% of females and 55% of males usually check their smartphones for any new notifications or calls as soon as they wake up in the morning. As depicted in Tables: 2 and 3, about 53.93 % of females and 35% of males cannot even imagine living without their smartphones for a week. 32.58% of females and 23.75% of males would be in stress if they are not able to use their smartphone for a day. About 36.73% of males and 27.8% females felt nervous or stressed when they were out of contact from their smartphones.

Table 2: Questionnaire on effect of smartphone addiction on academics

<table>
<thead>
<tr>
<th>Effect of smartphone usage</th>
<th>Females (%)</th>
<th>Males (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I spend more time on phone before the day of examination, than the other days, to get rid of my fear for the next day’s examination.</td>
<td>25.84</td>
<td>20</td>
</tr>
<tr>
<td>I usually check my mobile phone for messages/ surfing while attending classes/gaming</td>
<td>21.34</td>
<td>23.75</td>
</tr>
<tr>
<td>I frequently send SMS or use social networking while studying or doing any other work.</td>
<td>39.32</td>
<td>56.25</td>
</tr>
<tr>
<td>I frequently check my cell phone during classes.</td>
<td>7.8</td>
<td>68.75</td>
</tr>
<tr>
<td>I score less marks in the examinations if more time is spent on my phone.</td>
<td>44.94</td>
<td>25</td>
</tr>
<tr>
<td>Examination fraudulence is widespread with the use of mobile phones by students.</td>
<td>32.58</td>
<td>21.25</td>
</tr>
<tr>
<td>I bring my smartphones to college even though it’s usage inside the premises is prohibited.</td>
<td>39.32</td>
<td>61.25</td>
</tr>
</tbody>
</table>

**Table 3: Health hazards due to excessive use of smartphones**

<table>
<thead>
<tr>
<th>Health hazards</th>
<th>Females (%)</th>
<th>Males (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleep loss at night</td>
<td>41.57</td>
<td>27.50</td>
</tr>
<tr>
<td>Light-headedness, blurred vision (eyestrain)</td>
<td>29.21</td>
<td>43.75</td>
</tr>
<tr>
<td>Pain in the wrists, thumbs or shoulders</td>
<td>33.71</td>
<td>55</td>
</tr>
<tr>
<td>Headache or earache</td>
<td>37.08</td>
<td>30</td>
</tr>
</tbody>
</table>

In our study 34.22 % of males and 20.19% of females disagreed to coping with irritation while they were out of mobile phone contact. About 21.16 % of males and 18.64 % of females felt angered or insecure when they felt things were out of their control.

**Median nerve conduction velocity assessment**

The study sample for the assessment of the variability in the conduction velocity of median nerve. The velocity were selected on the basis of the answers provided by the subjects to Q. 34 of the Smartphone Addiction Scale Questionnaire. About 7.86 % (n = 7)
of females, however only (n = 3) females 3.75% had consented for the evaluation and 96.25% (n = 77) of males played PUBG for 2-3 hours on a daily basis (Fig:4).

Age-wise distribution of the study sample who agreed to playing PUBG for at least 2-3 hours a day. Out of the seven females who play PUBG for 2-3 hours daily, the other four did not give consent to participate in the assessment of variability of conduction velocity of median nerve. Therefore, the total number of participants who consented to participate in the assessment of the variability of conduction velocity of median nerve were 77 males and 3 females. Population pyramid of males and females who play PUBG (violent shooting games) were 77 and 3 respectively. The average age of the study sample was 19.85 ± 0.89 years with 96.25% (n = 77) of males and 3.75% (n = 3) of females. The only inclusion criterion for this study was to play PUBG or any other violent shooting games which primarily involves the usage of thumb and other fingers as a supplementation. Hence, the median nerve was checked and its motor distal latency (MDL) and conduction velocity of median nerve (CV) was recorded and mTLI was calculated. The average blood pressure of the study sample was 117.18± 8.069 mmHg of systolic blood pressure and 83.425± 9.176 mmHg of diastolic blood pressure. The average weight of the study sample was 72.90± 13.83 kg and the average height of the study sample was 171.17 ± 6.33 cm. Though, anthropometric data had an influence on the nerve conduction velocity (13), it was not significant as compared to the excessive gaming and chronic smartphone usage.

The average latency and the velocity of conduction of the right median nerve was 10.91 ms and 38.93 m/s. The average latency and the velocity of conduction of the left median nerve was 11.17 ms and 30.029 m/s. Terminal latency index (mTLI) was calculated using the formula: mTLI = Distal nerve conduction distance (80 mm) / (proximal motor conduction velocity (MCV) × distal motor latency). A value of <0.35 is considered as abnormal.

About 96.25% (n = 77) and 92.50% (n = 74) of the study sample had an abnormal left and right median nerve terminal latency index. Overall, 94.3% of the subjects had decreased terminal latency index (Fig: 5 and 6).

**DISCUSSION**

Due to the ever-increasing time people spend with technology which has deleterious effects on health, the present study’s investigation on mobile phone dependence pattern and the prevalence of Nomophobia is very important. It is not only habit forming, but also addictive; "possibly the biggest non-drug addiction of the 21st century" or the ‘disorder of the 21st century’ (10).

In our study, Nomophobia prevalence was found to be 37.39%. The prevalence was comparable to a study conducted by Bivin et al. (14) where 23% of the subjects were suffering from nomophobia. In a study conducted by Dixit et al., (15) 18.5% of the subjects were suffering from nomophobia. In contrast to the findings of our cross-sectional study, the study conducted by Sharma et al., (16) found out that about 73% of their subjects were suffering from nomophobia. Similarly, the study conducted by Dongre et al., (10) concluded with the prevalence of nomophobia among their subjects to be 68.92%.

In our study, about 39.30% of females were found to be suffering from nomophobia as compared to 35.7%
of males, thereby showing a female preponderance in nomophobia. This is in contrast to many other studies like Pavithra et al.,(17) where they concluded that about 44.8% of males were nomophobic compared to females who were just 33.70% in number. About 30.76% of the study sample started using their mobile phones less than 5 years and about 35.5% of the subjects started using their phones less than 3 years. In the study by Bivin et al.,(14), about 91.04% of the study population were using their mobile phones for more than 3 years.

This increased prevalence could be due to the fact that mobile phone has become a necessary and unique accessory for everyone, applications and new facilities provided in mobile phones provide novelty seeking individuals a new experience to purchase and enjoy playing these advanced communication tools. The behaviours driven by novelty seeking tend to lose self-control and increase impulsivity and hence dependence on this tool.

The mean age of the study sample was 20.5 ± 1.11 years. Similarly, the mean age of the subjects was 24.22 ± 5.02 in the study conducted by Prasad et al.,(18) to study the effects of mobile phone use. About 51.47% of the study sample was of 19 years of age, 32.54% being at the age group of 20 years. 12.4% of 21 years old subjects and 3.5% of subjects who were 22 years of age with a larger proportion of nomophobia students falling in the range of 19-21 years.

In our study about 49.11% of the study sample experienced false perception of ringtone also known as ringxiety or phantom ringing and 64.4% among subjects as carried out by Mittal et al.,(19). In contrast, ringxiety was experienced in 21% of the subjects in a study conducted by Sharma et al.,(16). About 31.95% of the study population spent more than 2 hours on calls compared to 31% students who have at least one long duration call per day for 30 minutes in the study conducted by Dixit et al.,(15)

29.58% of the study sample spent their time on social media apps. 56% used mobile phone for social media networking as reported by Pavithra et al.,(18). However, in our study about 49.7% of the subjects spent their time playing PUBG (96.25% of males and 7.86% of females) having no previous references for comparison. In our study, 34.91% of the subjects suffered from lack of sleep at nights as compared to 43% of the subjects in the study by Ramesh and Masthi (20).

The most common clinical manifestation that the study sample suffered from was thumb ache or wrist pain where 43.78% followed by eye-strain or blurred vision in 36.09% of the subjects. This was comparable to the study conducted by Acharya et al., (21) where they reported 36.5% of the subjects to suffer from eye-strain. In our study about 27.21% of the students agree to usage of mobile phones as an approach to examination fraudulence. This was also studied by Hossain (22) where 24.8% students used mobile phones for unfair means inside the examination hall. About 35.5% agree to scoring low marks in the examination if more time is spent on their mobile phones compared to the study by Hossain (22) where 29.9% agreed to their low scoring.

47.33% of our study subjects frequently messaged or used social media networking while studying or doing any other work whereas about only 31.4% agreed that they waste time by sending/writing SMS while doing class work. About 36.73% of males and 27.8% females felt nervous or stressed when they were out of contact from their smartphones. In our study 34.22% of males and 20.19% of females disagreed to coping with irritation while they were out of mobile phone contact as compared to 28% of study subjects in a study conducted by Ramesh and Masthi (21).

Excessive gaming (PUBG) as per our hypothesis reduced the latency and the velocity of conduction the median nerve because it involves the thumb usage and other fingers. mTLI (Terminal Latency Index) and mRL (Residual Latency) are parameters of electrophysiology for identification of abnormalities in the distal segment of motor nerves. In our study we used mTLI and mMDL for determining the latency of the median nerve, where 96.25% of the subjects had an abnormal left median nerve terminal latency and 92.5% of the subjects had an abnormal right median nerve terminal latency.

The mean TLI in our study was recorded to be 0.118 ± 0.086 indicating a high risk of carpal tunnel syndrome as compared to the similar findings study conducted by Simovic et al.,(23) and the m-TLI was a sensitive electrophysiologic parameter for the presence of CTS. However, based on the conduction velocity about 88.75% and 82.5% of study subjects had lesser than normal (17) left and right median nerve conduction velocities proving our hypothesis.

There are many other electro-diagnostic measures which could be more sensitive and specific for the determination of various health hazards caused due to excessive gaming like carpal tunnel syndrome, De Quervain’s syndrome or myofascial pain. The present observations in our study from a small group of male and very few female students, which may not reflect the present scenario worldwide because millions of cellular mobile users are getting added every month indicating that full blown Nomophobia has all the possibilities to reach to the epidemic scale. These results provide an alarming indication that as days goes by the youth is getting more and more dependence on mobile phones, which may lead to serious psychiatric and psychological problems among the users.

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CONCLUSION

As per the ICD-10 diagnostic criteria, the prevalence of nomophobia in our study was found to be 37.39% for dependence syndrome. The most common clinical manifestations were found to be thumb and wrist pain followed by eye strain, lack of sleep and headache or earache. The most common behavioural manifestations were feeling nervous or stressed followed by the inability to cope with irritations.

The results of this study show the mobile phone dependence among male undergraduate students of health sciences. The data is indicative of Nomophobia to be an emerging problem of the modern era and hence the study proves Nomophobia to be ‘The Disorder of the 21st Century’. More research is to be taken ahead in this way as nomophobia will soon prove to be the ‘Digital Plague’ of the world. Prevention is better than cure and hence medical education to school-going children, teenagers and adolescents about the risks of excessive smartphone usage should be done as they are the most vulnerable to this disorder.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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Biomedicine- Vol. 42 No. 3: 2022

573