



Mobile phone use and its effect on quality of sleep in medical undergraduate students at a tertiary care hospital

Abstract

Background: Professional college students are very prone to sleep deprivation and have poor quality of sleep. Mobile phone use may have a significant impact on sleep quality and length. There is paucity of information regarding mobile phone usage and quality of sleep among the medical students in India. The present study was undertaken to evaluate the prevalence of mobile phone use among medical undergraduate students and its effect on sleep quality and daytime sleepiness.

Methods: This was a cross-sectional study involving 100 medical undergraduate students. Participants were categorised into low, medium, and high mobile phone users based on duration of mobile phone use and frequency of calls/short message service (SMS) per day. Sleep quality and daytime sleepiness were assessed by the Pittsburgh Sleep Quality Index (PSQI) and the Epworth sleepiness scale (ESS) questionnaires respectively. The impact of phone usage on various sleep quality parameters was also assessed. **Results:** A total of 36%, 32%, and 32% students were in high, medium, and low mobile phone users groups respectively. The mean PSQI scores were 4.57 ± 1.22 , 5.56 ± 1.01 , and 7.44 ± 1.21 ($p < 0.0001$) for the low, medium, and high users respectively while the corresponding values for mean ESS scores were 6.23 ± 1.55 , 7.16 ± 2.06 , and 9.26 ± 1.76 ($p < 0.0001$; one way ANOVA=23.93). All the sleep quality parameters except habitual sleep efficiency and use of sleep medications were adversely affected with increasing mobile phone usage. **Conclusion:** Increasing mobile phone use adversely affects the sleep quality and causes daytime sleepiness among the medical undergraduate students.

Keywords: College. Impact. Usage.

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Received: 3 May 2017

Revised: 19 November 2018

Accepted: 8 January 2019

Epub: 14 February 2019

DOI: 10.5958/2394-2061.2019.00028.4

INTRODUCTION

The modern era is witnessing a surge in use of mobile phones for multiple functions like voice calls, emails, instant messaging, and social networking. In medical field, mobile phones find multiple uses like medical calculators, log books, drug guidelines, medical guides, and medical reference tools, and thus, have an important place in medical healthcare.[1]

Excessive usage of mobile phones may put the user at an increased health risk. A study conducted in the United States has reported increased predisposition to subjective distress, loneliness, and social isolation.[2] Self-reported symptoms of overexposure to electromagnetic fields of mobile phones include earache, feeling of warmth near the ear, headache, concentration difficulties, and fatigue.[3] Overuse of these gadgets may not only result in memory loss, sleep disturbance, nausea, and dizziness but may also predispose to cancer.[4] However, a study from Germany showed no relation between the overuse of mobile phones and the incidence of brain tumours.[5]

Sleep is essential for physical, mental, and emotional wellbeing of an individual. College students are recognised

as an important sleep-deprived but most technologically-oriented population. It has been shown that professional college students in the United States are very prone to sleep deprivation and have poor quality of sleep.[6] It has been demonstrated that individuals who do not sleep well are not able to perform a complex cognitive task as nicely as those who got enough sleep.[7] Sleep-deprived individuals are also expected to learn less than those who have had a good night's sleep.[8]

Thomée *et al.*[9] conducted a cross-sectional study on 4156 young adults and reported that high mobile phone use was associated with sleep disturbances and symptoms of depression in men, and depressive symptoms only in women users. Massimini and Peterson[10] reported that excess use of mobile phones by college students may cause significant class tardiness and sleep deprivation. They also found a significant relationship between sleep length and addictive mobile phone behaviour.[10] Mobile phone use may significantly impact sleep quality and length. White *et al.*[6] examined the relationship between sleep quality and length and mobile phone use among 350 college students, and concluded that various aspects of mobile phone use such as problem mobile

phone use, addictive text messaging, problematic texting, and pathological texting are related to sleep quality, but not to sleep length.

Students using mobile phones for calling, texting, and browsing the Internet are likely to experience significant class tiredness and sleep deprivation.[10] Mobile users can be divided into low, medium, and high depending upon the frequency of short message service (SMS) sent or received, frequency of calls made and received per day. Low mobile users have zero to five frequency of calls and SMS each, medium mobile users have six to ten frequency of calls and SMS separately, whereas high mobile users can have >11 frequency of calls and SMS each.[9] However, there is paucity of information regarding mobile phone usage and quality of sleep among medical students in northern India.

Objectives

The present study was carried out on medical undergraduate students to evaluate the:

- Mobile phone use (low, medium, and high)
- Effect of mobile phone use on sleep quality and daytime sleepiness.

MATERIAL AND METHODS

The present study was a cross-sectional study involving medical undergraduate students of fourth semester at Pandit BD Sharma Post Graduate Institute of Medical Sciences, Rohtak, Haryana, India who voluntarily agreed to participate in this study. The participants were recruited from 1 June to 31 July 2014 and were informed about the study conduct, procedure, risks and benefits, privacy, confidentiality, and voluntary participation in this study, and a written informed consent was obtained. Ethical clearance was obtained from the Institute Ethics Committee before the start of the study. One hundred medical undergraduate students having mobile phones were included while those unwilling to give written informed consent, those not owning a mobile phone, those likely to face examination, unit test, seminar presentations within one month, on night duty in hospital/ward, those with a family history of mental illness, and those with history of any mental illness or on chronic medication were excluded from the study.

All the eligible participants were administered a case study form which consisted of questions related to demographic

profile (details about the participant including the name, age, sex, and admission batch), factors likely to affect sleep and the extent of mobile phone usage (consisting of multiple choice questions regarding frequency of calls and SMS).

Mobile phone users were divided into low/medium/high mobile users depending on the frequency of calls and SMS.[9] As mobile is now also being extensively utilised for other services like the Internet literature search, social network site, gaming, music etc., hence, the authors added the duration of mobile phone usage to the above criteria. The modified criterion was validated and then used in the existing study to find out the prevalence of mobile phone use (Table 1).

Assessment of sleep quality

The Pittsburgh Sleep Quality Index (PSQI) questionnaire was administered to the participants to assess the sleep quality.[11] PSQI, an efficient tool for measuring the sleep quality during the night, contains 19 self-rated questions and five questions for the roommate. Only the self-rated questions are included in the score. The questions are divided into seven component scores with each component describing different components of sleep like subjective sleep quality, sleep latency, sleep duration, etc. and have a scoring system in the form of zero to three where 'zero' indicates no difficulty and 'three' indicates severe difficulty. All the component scores are added up to get the grand score between zero and 21 with 'zero' indicating no sleep problems and '21' as extensive sleep problems.

Assessment of daytime sleepiness

The commonly used and validated Epworth sleepiness scale (ESS) questionnaire was used to assess the daytime sleepiness in the participants.[12] ESS consists of eight questions related to day-to-day activities with a four-point Likert scale from zero to three with 'zero' indicating no chance of dozing and 'three' as maximum chances of dozing during daytime. All the scores were added up and a final total score was calculated ranging from zero to 24. Scores greater than 16 indicate low quality of sleep resulting in excessive daytime sleepiness while scores more than ten and up to 16 are considered moderately sleepy.

Statistical analysis

Data was expressed in mean \pm standard error of mean (SEM), median (interquartile range [IQR]), and number (%).

Table 1: Calculation of mobile phone usage in the study

Division	Frequency of calls/day	Frequency of SMS/day	Duration of mobile use/day	Mobile phone use
Low	0-5	0-5	<2 hours	Low calls+Low SMS+Low duration
Medium	6-10	6-10	2-4 hours	Low calls+Medium SMS+Medium duration
				or
				Medium calls+Low SMS+Low duration/Medium duration
High	>11	>11	>4 hours	High calls and/or High SMS+High/Medium duration
				or
				Medium calls+Medium SMS+High/Medium duration

SMS=Short Message Service

Intergroup comparison of sleep quality (global PSQI score) and sleep quality parameter (components of PSQI score) were statistically analysed by using the Kruskal-Wallis test followed by Dunn post Hoc test. Intergroup comparison for daytime sleepiness (ESS score) was done using one way analysis of variance (ANOVA). p-value less than 0.05 was taken as significant.

RESULTS

Mobile phone usage

In our study of the 100 participants, 56 were male and 34 were female. A total of 36 participants were high mobile phone users while 32 each were low and medium users. The prevalence of mobile phone usage among the male (35% each in high and medium, and 30% in low user group) and female (34%, 40%, and 26% participants in high, medium, and low user groups respectively) participants was almost similar.

Sleep quality

The global PSQI scores in the study ranged between three and ten. It is evident that there is an increase in the global PSQI score with increase in mobile phone usage which was statistically significant between low, medium, and high groups when compared with each other (Table 2).

Components of PSQI scores

It was observed that sleep quality parameters like subjective sleep quality, sleep latency, sleep duration, sleep disturbance, and daytime functions were maximally (statistically significant) affected in the high mobile usage group (Table 3).

Habitual sleep efficiency and use of sleep medications were similar in all the groups of the study. Of the five significantly affected components of PSQI questionnaire, components

three (sleep duration) and five (sleep disturbances) were maximally affected in high mobile phone users in comparison to both low and medium users. The difference in the mean component scores of subjective sleep quality, sleep latency, and daytime function of medium users were insignificantly higher than those of low mobile phone users.

Daytime sleepiness

ESS scores in the study ranged from four to 12 with 19% students reporting scores from ten to 12 indicating moderate sleepiness. The mean ESS scores for low, medium, and high mobile phone users in our study were 6.23 ± 1.55 , 7.16 ± 2.06 , and 9.26 ± 1.76 respectively. Similar to the trend seen in the mean global PSQI score, an increase in the mean ESS score was also observed with increase in mobile phone usage and was found to be statistically significant between low, medium, and high groups when compared with each other.

Mobile phone usage after bedtime

In our study, it was also seen that 18 of the 36 (50%) students in the high mobile usage group used mobile phone at bedtime as compared to two (6.25%) and four (12.5%) students in the low and medium mobile usage groups respectively.

DISCUSSION

Most of the available literature on college students relates to their sleep patterns, stress, and psychiatric disorders. Medical students grapple with intense academic pressures in addition to stress on personal and social fronts. Having been exposed to technology from a young age, college students are more technology savvy and tend to fall back on it for social support. Mobile phones provide a frequent communication access (through texting, chatting, and email) with friends and family, and thus, increase the perceived social support. This

Table 2: Mean global PSQI score in the various mobile phone usage groups

Groups	Mobile phone usage			Kruskal-Wallis test	p-value	Dunn post hoc test
	Low (L)	Medium (M)	High (H)			
Mean global PSQI score	4.57 \pm 1.22	5.56 \pm 1.01	7.44 \pm 1.21	51.93	<0.0001	L v/s H: <0.001 L v/s M: <0.05 M v/s H: <0.001

PSQI=Pittsburgh Sleep Quality Index

Table 3: Comparison of various sleep quality parameters in the study

Components of PSQI	Mobile phone usage			Kruskal-Wallis test	p-value	Dunn post hoc test
	Low (L)	Medium (M)	High (H)			
Subjective sleep quality	0.83 \pm 0.53	1.12 \pm 0.42	1.38 \pm 0.55	15.89	0.0004	L v/s H: <0.001
Sleep latency	0.87 \pm 0.34	1.09 \pm 0.39	1.32 \pm 0.53	15.25	0.0005	L v/s H: <0.001
Sleep duration	0.97 \pm 0.76	1.28 \pm 0.68	2.06 \pm 0.85	25.14	<0.0001	L v/s H: <0.001 M v/s H: <0.01
Sleep disturbance	1.03 \pm 0.18	1 \pm 0.25	1.41 \pm 0.5	22.6	<0.0001	L v/s H: <0.001 M v/s H: <0.01
Daytime Function	0.83 \pm 0.38	1.03 \pm 0.4	1.23 \pm 0.43	13.74	0.001	L v/s H: <0.001

PSQI=Pittsburgh Sleep Quality Index

could account for the high mobile phone usage by medical students irrespective of their gender as seen in our study. However, the benefits of such social support may be negated if some of these interactions turn stressful. Further, a decline in study habits and grades, an increase in missed classes and academic position, loss of sleep has been linked to 'excessive' Internet usage by college students.[13]

Adequate sleep quality is an essential health need of every individual. College students tend to become sleep deprived in their efforts to keep pace with the fast-tracked, technologically-oriented society.[14] A significant reduction in quality of sleep among medical students with increasing mobile phone usage was also evident in our study. Caldwell and Gilreath Caldwell[15] demonstrated that 75% of college students complain of fatigue after getting just one hour less than the optimum eight hours. Those who had a normal night's sleep also demonstrated to have a better academic performance compared to their sleep deprived peers. Moreover, reduction in sleep length practically reduces the duration of the essential rapid eye movement (REM) sleep that occurs during the latter half of normal sleep duration. A relationship between REM sleep and learning has been documented and an interference with REM stage of sleep may adversely impact learning.[8]

Research in terms of mobile phone use and sleep among medical undergraduate students, and in particular, is virtually lacking. To the best of our knowledge, the present study is the first to evaluate the relationship of mobile phone use and sleep quality among medical students. Massimini and Peterson[10] reported that 62.9% of undergraduate university students communicate with friends by text messaging. They noted that talking on mobile phones, using email, Instant Messaging (IM), Social Network Services (SNS), Internet browsing, and misplacing mobile phones results in significant class tardiness and sleep deprivation. A significant relationship between sleep length and addictive mobile phone behaviour was also demonstrated in the study.[10] However, White *et al.*[6] in their study on 350 psychology students found no association between sleep length and overall mobile phone use but reported a significant relationship between overall addictive text messaging and poor sleep quality. The results of the present study support that mobile phone's use and sleep quality are inversely related.

Half of the students in the high usage group in our study used mobile phones after bedtime/lights out; thus, suggesting an urge to remain connected even when they are physically tired and would wish to sleep. This urge may actually prevent them from entering into deep sleep. An inability to enter deeper planes of sleep or even spending less than optimum time in deep sleep may result in tiredness and sleepiness in the subsequent day. This is corroborated in our study where high mobile phone usage was positively related to higher ESS score indicating daytime sleepiness. It has also been suggested that college students develop an 'ear' for their mobile phones and that such individuals do not experience quality sleep as their brain tends to repeatedly bring them to a lighter stage of sleep; thus, resulting in daytime tiredness.[6] Considering the rampant mobile phone use by medical students, the results of this study may have important implications both for their mental and physical health, and for academic performance.

Conclusion

The findings of this study suggest that high mobile phone usage by medical students adversely impacts their sleep health. It suggests that high mobile phone usage by medical students adversely impacts their sleep quality and cause daytime sleepiness. Sleep duration is the most affected component in sleep quality and is directly proportional to the mobile phone usage. Use of mobile phone in bedtime adversely affects sleep quality. This may have important physical, emotional, and academic implications for this young technologically oriented population.

The present study is based on self-reports and there is a need to develop more objective measures of sleep quality assessment. Paucity of scientific data of sleep quality assessment in context of mobile phone usage also warrants large scale research in this area.

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Kadian A, Mittal R, Gupta MC. Mobile phone use and its effect on quality of sleep in medical undergraduate students at a tertiary care hospital. *Open J Psychiatry Allied Sci*. 2019;10:128-31. doi: 10.5958/2394-2061.2019.00028.4. Epub 2019 Feb 14.

Source of support: The study was funded by the Indian Council of Medical Research (ICMR) under Short Term Studentship (STS) 2014.
Declaration of interest: None.