Electronic Gadget Screen-time, Perceived Sleep Quality & Quantity and Academic Performance in Medical Students

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Abstract

Background: Exposure to blue light has been found to affect sleep. Reduced sleep has been found to affect academic performance. However, electronic gadget screen time, sleep quality and quantity and academic performance in undergraduate medical students has not been explored so far. The primary objective of this study was to explore Electronic Gadget Screen time, sleep quality, and sleep quantity and academic performance in Medical students.

Methods: The study was done in JSS Medical College, Mysuru. 400 students from under graduate course were selected through clustered random sampling. Data of electronic gadget usage was collected using a pre-tested proforma. Data of sleep quality, quantity was collected using Pittsburg Sleep Quality Index. Data of academic performance was collected from the marks sheet provided by the college authorities.

Results: Average screen time overall was 5.13 hours per day. On the whole, total Screen time does not have a direct relationship with sleep quantity or quality or academic performance. Rather than the total screen time, bed time gadget use seems to have a more significant relationship with academic performance.

A non-significant relationship has been identified between screen time and quality of sleep with a p value= 0.2. Higher academic performance correlated with better sleep quality and better global PSQI scores.

Conclusion: Bed time screen exposure plays a significant role in determining sleep quality, quantity and in turn academic performance.

Introduction

Sleep is a basic necessity for survival. While we sleep, important physiological events take place in the body. The importance of sleep is more pronounced in college students. Memory recall and ability to maintain concentration are much improved when an individual is rested. Prolonged sleep deprivation will affect mood, energy level and ability to focus, concentrate and learn, which directly affects academic performance. Decreased sleep quality has been correlated with having worse academic outcomes and poorer sleep quality.¹

Electronic gadgets like laptops, Tablets, PCs, TVs have become an integral part of our modern lives and our work flows. However, these devices emit a spectrum of light. Among the whole spectrum, blue light is the one we are interested in and it has numerous sources. Daylight from the sun is the chief source followed by artificial sources in the form of LED lights, gadget screens. Blue light was found to impact the secretion of melatonin (N-acetyl-5-methoxytryptamine) in the Suprachiasmatic Nucleus.² Suprachiasmatic nucleus, which keeps signaling throughout the day, influences the pineal gland such that the levels of melatonin keep fluctuating throughout the day.³

Thus production and secretion of melatonin occurs with a clear diurnal pattern. The peaking of melatonin secretion was found to be highest at night.⁴ Once produced, melatonin circulates through the CSF and Blood stream looking for receptors in target organs like brain, retina, cardiovascular system, liver and gallbladder, colon, skin, kidney.³

This relationship provides information to the body that adjusts peripheral organs to the light-dark cycle. However, as we increase our screen times and hence the exposure to artificial light from the screens exposure to mobile screens delay the onset of sleep and cause sleep displacement.⁶

Studies looking into the concept of sleep displacement as a 2 step process have also been undertaken where the process has been classified into bedtime, shuteye time.⁷ However, studies looking into Under Graduate medical students (UG MBBS students) with respect to the above concepts are scanty.

Hence, we carried out this study to assess the effects of screen time on sleep and academic performance in UG medical students. The primary objective was to explore Electronic Gadget Screen-time, sleep quality, sleep quantity in medical students and their association if any.

Subjects and Methods

Institutional Ethics Committee clearance was obtained.

It was a prospective observational study done at JSS Medical College, a premier medical institution attached to JSSAHER in the heritage city of Mysuru, Karnataka state in South India.

The study was carried out over...
are using older android models, were time in iOS and iPad OS). Those who wellbeing in android” and “screen settings (can be searched as “digital built into their smartphone and tablet identify their “screen on time” that is Students were demonstrated how to use the app – Digitox: Digital Wellbeing – Screen time. Data with respect to sleep quality, quantity was collected using Pittsburgh Sleep Quality Index (PSQI). The data regarding academic performance was collected based on the marks sheet provided by the college authorities and total percentage of marks in the final university exams of their respective years were taken into consideration. PSQI is a self-reporting questionnaire that assesses sleep quality and quantity over a 1-month time interval and consists of 19 individual items creating 7 components that produce one global score. PSQI has been found to be reliable and valid. PSQI has been utilized in various research / clinical settings. A 2017 study used the index to compare Sleep quality outcomes after medical and surgical management of chronic rhino sinusitis. More recently, University of New South Wales, Sydney used the index to study music as a prescription to aid the quality of sleep.

Results

The overall reliability coefficient alpha (Cronbach’s alpha) for PSQI was 0.744 which is satisfactory. Total number of participants were 400. However, only 398 were analyzed as there were 2 drop outs from third year who did not return their filled proforma. Hence, 398 proformas were analyzed. Out of the 398 filled proformas, 207 were female and 191 were male. 100 participants were from first year, 98 from second year, 100 from third year, and 100 from final year. 52 subjects from first year were male and 48 were female. 55 subjects from second year were male and 45 were female. 45 subjects from third year were male and 55 were female. 39 subjects from final year were male and 61 were female.

The average screen time recorded overall for all the subjects was 5.13 hours per day. No significant difference was observed between average screen time of male and female subjects. Most commonly used gadget was smartphone. On the whole, total Screen time does not have a direct relationship with sleep quantity or quality or academic performance (Figure 1).

A significant portion of the subjects had the habit of using gadgets before sleep (68%). Rather than the total screen time, bed time gadget usage seemed to have a more significant relationship with academic performance. Bed time gadget use had a significant adverse relationship with sleep quality and quantity (Table 1). Perceived quality of sleep and bedtime use of gadget had significant association in the participants who perceived their sleep quality as “Fairly good” and “Fairly Bad” groups whereas in the group with “Very good” sleep quality a reverse relationship was noted. An overall p value <0.0001 was noted (Figure 2).

Bed time gadget use was found to have a significant adverse impact on the time taken to fall asleep (sleep latency). Bed time gadget use had a significant adverse relationship with academic performance of the students (Table 2). A significant adverse relationship was noted between total screen time and the

![Fig. 1: Relation between sleep duration and total screen time](image1)

![Fig. 2: Bed time gadget use in various groups of perceived sleep quality](image2)

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<tr>
<th>Use of gadget before bed</th>
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Table 1: Relationship between sleep quantity and gadget usage

Inclusion criteria was MBBS students who possessed and use any form of electronic gadgets and were consenting to participate in the study. Exclusion criteria was MBBS students who have disturbed sleep due to any disease states. The participating students were explained regarding the study and written informed consent was taken. Confidentiality, voluntary participation and non-threatening processes were ensured. They were asked to fill up 2 proformas in total.

Data regarding usage of electronic gadget usage was collected using a pre tested proforma including self-reported usage of the type of electronic gadget (TVs, PCs, Laptops, Tablets, Smart phones etc.), self-reported screen-time (average number of hours per day, average number of days per week, time period of usage just before bedtime etc.). Self-reported screen time was based on data from android mobile phone or an app downloaded by the students(Digitox : Digital Wellbeing - Screen Time - Apps on Google Play). Students were demonstrated how to identify their “screen on time” that is built into their smartphone and tablet settings (can be searched as “digital wellbeing in android” and “screen time in iOS and iPad OS”). Those who are using older android models, were shown how to use the app - Digitox: Digital wellbeing – Screen time.

A significant adverse relationship was noted between total screen time and the average number of days per week, time period of usage just before bedtime (Figure 2). However, only 398 were analyzed as there were 2 drop outs from third year who did not return their filled proforma. Hence, 398 proformas were analyzed. Out of the 398 filled proformas, 207 were female and 191 were male. 100 participants were from first year, 98 from second year, 100 from third year, and 100 from final year. 52 subjects from first year were male and 48 were female. 55 subjects from second year were male and 45 were female. 45 subjects from third year were male and 55 were female. 39 subjects from final year were male and 61 were female.
time taken to fall asleep (sleep latency). Sleep latency also carries a significant adverse relationship with academic performance. Increasing global PSQI score had an adverse relationship with academic performance. This proves the importance of sleep with respect to academic performance.

Both total screen time and bed time usage of gadgets was found to influence sleep latency. Bed time usage of gadgets has an impact on the quantity and quality of sleep. Sleep latency and Quality of sleep affects academic performance. Though direct correlation is not evident in the analysis, we can infer that both total screen time and bedtime usage have a negative impact on sleep latency, sleep quantity and sleep quality which in turn may have a negative impact on academic performance.

Discussion

The objective of this study was to explore electronic gadgets' screen time and its association with sleep quality, quantity and academic performance in undergraduate medical students. A total of 398 students were part of the study and they were spread across 4 different years during the MBBS course.

Screen time: The average screen time recorded overall for all the subjects was 5.13 hours per day. Average screen time for male subjects was 5.17 hours/ day and for female subjects it was 5.09 hours/day. This was significantly higher when compared to the screen time of 2 hours as reported by a similar study done in December, 2017 in Tamil Nadu.1 The first-year medical students had the highest screen time 5.6hrs/day. However, there was no particular trend that was noted among different batches. Most commonly used gadget was the smartphone (100%), followed by laptops (78.7%) and tablets at (42.3%).

Sleep quality: 82 subjects had reported to have very good sleep quality, 219 subjects reported their sleep quality as fairly good, 97 subjects as fairly bad. However according to PSQI grading based on Global PSQI scores, 88.5% of the subjects were found to have poor sleep quality (PSQI >5) and 11.5% had good sleep quality (PSQI <5). This represents a higher fraction of people with poor sleep quality when compared to previous literature.1

Bed time gadget use: More than 2/3rd of the subjects were found to use a gadget within 30 minutes of bed time. This accounts to 273 (68.5%) subjects out of the total 398. There was no significant variation between each year with respect to bed time gadget usage. The highest usage at bed time was seen among 4th years whereas lowest was seen in second years.

Screen time and sleep quantity: With respect to screen time and sleep quantity, a negative correlation was noted between total screen time and sleep quantity (Pearson correlation= -0.065). The correlation between the parameters though was not significant (p=0.194). The results from our findings are in contrast to other studies which have found a direct significant correlation between overall screen time and the quantity of sleep.1 Similar findings were noted in American pediatric population where they found a modest impact of screen time on sleep quantity.11 However, once the subjects were grouped according to their duration of screen time, there was a moderately significant relationship between duration of sleep and screen time. Except subjects with >7 hours of sleep, others had an inverse relationship between screen time and duration of sleep with a p value=0.03.

Screen time and academic performance: Screen time did not significantly correlate as a whole with academic performance. This is also in contrast to older studies where it was identified that screen time had directly and negatively correlated with academic performance of the subjects.1,12,13 It had an insignificant correlation with an overall p value=0.325 in our study. We anticipated a positive correlation with academic performance at higher screen times. However, it was not found in our study. This pattern is probably due to the fact that quoted studies being carried out 3 years prior to our study and the increasing prevalence of eBooks which need either a mobile phone, tablet or a laptop to read. This might be an indication of changing trend in the way students read their books and changes in the way gadgets play a role in a student's life. Interestingly Male subjects had a significant positive correlation between academic performance and screen on time. We were able to identify one study where it was concluded that total screen time has either minimal or no effect on sleep time; however, this study was performed in pediatric population.14

Screen time and quality of sleep: Increasing screen time showed a negative correlation with quality of sleep. The same continued to be true after doing a sub-analysis into various academic years except in final year students, where poorer sleep quality was independent of screen time. However, the correlation in our study was not statistically significant with a p-value=0.2.

Screen time and time taken to fall asleep: Total screen time had a significant correlation with the time taken to fall asleep. The average screen time for subjects needing >30 minutes to fall asleep was 5.58 hours, whereas, those needing <15 minutes was 4.98 hours.

Bed time gadget use and sleep quality: Bed time gadget use was found to be positively correlating with the duration of sleep and the perceived quality of sleep irrespective of gender or the year in MBBS. The overall correlation was highly significant with a p-value=0.0001 for both the quantity and perceived quality of sleep. Similar results have been noted in previous studies where correlation has been noted between the usage of electronic gadgets within 30 minutes, within 1 hour, and the number and types of gadgets used. In pediatric studies, watching TV at bedtime accounted for 30min less sleep.15 This phenomenon is probably secondary to melatonin suppression in response to the blue light from the gadget screens.

Bed time gadget use and time taken to fall asleep: In our study, that time taken to fall asleep was higher in
subjects who used gadgets at bedtime and it carried a significant correlation \( p=0.002 \). The same significant correlation carried forward when analyzed by gender and academic year. This solidifies the previous findings from other studies that bedtime gadget usage is significantly associated with poorer sleep quality and quantity. The probable cause for delay of sleep might be suppression of melatonin secretion, displacement of the sleep by gadget use, psychological arousal resulting from usage of the gadgets. The maximum suppression of melatonin is found to be occurring at shorter wavelengths that correlates with blue light specifically. The bed time gadget usage and sleep quality: Usage of gadgets at bed time have been found to have a significant impact on duration of sleep with a significant correlation \( p<0.0001 \). Though there were numerous studies in pediatrics population measuring bed time gadget usage and sleep quality and quantity, very few studies have been carried out in the adult population. Here we have found a significant correlation that gadget usage 30 minutes before going to bed has a very significant impact on sleep duration. Even after being sub analyzed by the gender, bed time gadget use continued to have a significant impact on the duration of sleep with those using any form of gadgets within 30 min of sleep having lesser sleep duration as compared to those who did not use a gadget. The possible reason being, secondary to a delay in falling asleep, there might be an overall decrease in sleep duration. Generally, the waking up time in most of the individuals is fixed and less likely to be changing due to fixed lifestyle like the need to attend classes in the morning. Hence, going to bed on time becomes even more important. In our study, time taken to fall asleep (sleep latency) was influenced by both total screen time and bed time usage of gadgets, Bed time usage of gadgets had an impact on the quantity and quality of sleep. Sleep latency and Quality of Sleep affected academic performance. Though direct correlation is not evident in the analysis, we can infer that both total screen time and bedtime usage have a negative impact on sleep latency, sleep quality and sleep quantity which in turn may have a negative impact on academic performance.

**Strengths and limitations**

This study is one of the few studies undertaken in India and the first from this part of the country that looks at gadget use, sleep quality and quantity, and academic performance in UG Medical students. It included a large sample size and looked at multiple variables like sleep quality and quantity, bed time gadget usage, total screen times and the correlations they had among each other. However, the study was based on self-reporting by the subjects which always carries a bias. Further studies involving higher number of students with a larger sample size and higher number of variables like subjects’ physical activity, BMI scores is desirable. Other variables like accidental pruence, substance abuse, during the classes and performance during practical, anxiety were not included in the study which is also one of the limitations of this study.

**Conclusion**

On the whole, total Screen time does not have a direct relationship with sleep quantity or quality or academic performance. However, total screen time has a negative correlation with academic performance and also on sleep quality in males only. Rather than the total screen time, bed time gadget usage seems to have a more significant relationship with the sleep quality, quantity and academic performance. A significant proportion of the subjects had the habit of using an electronic gadget before sleep (68.5%). Total screen time had a significant negative correlation with the time taken to fall asleep (sleep latency). Bed time gadget use had a significant negative correlation with sleep quality, quantity. Bed time gadget use was found to have a significant negative impact on sleep latency. Bed time gadget use had a significant negative correlation with academic performance. Sleep latency has a significant negative correlation with academic performance. Increasing global PSQI score negatively correlated with academic performance. This study highlights the impact of gadget use and importance of sleep for academic performance.

**References**