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ORIGINAL ARTICLE

# Association between internet addiction and sleep quality among students: a cross-sectional study in Bangladesh

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## Abstract

Internet addiction has been a major behavioral disorder over the past decade. There remains a paucity of research to find the relationship between internet addictions and sleep quality in low- and middle-income countries such as Bangladesh. The aim of this study is to find the association between internet addiction and sleep quality among the medical college students. We conducted an analytical cross-sectional study in two medical colleges with 390 students in Dhaka, from December 2017 to May 2018. Pittsburg Sleep Quality Index was used to determine the quality of sleep and Orman's Internet Addiction Test was used to classify the severity of internet addiction. It appears that the prevalence of poor sleep quality is 69.5% among the students and 68.4% of the students are having moderate to severe internet addiction. The results of multivariate logistic regression model indicated that the students with moderate and severe internet addiction are 75% and 95% less likely to have good sleep quality, respectively (OR = 0.25, CI 0.141–0.407; OR = 0.05, CI 0.013–0.118; reference: no internet addiction). Besides, the students who live with family during the class (OR = 1.74, CI 1.02–3.11), with smoking habit (OR = 0.236, CI 0.093–0.551, reference: non-smoker), not brushing teeth before sleep (OR = 1.705, CI 0.932–3.189), and housewife mother (OR = 0.576, CI 0.313–1.056; reference: working mother) are significantly associated with the good sleep quality among the medical college students. This study indicates that a significant proportion of students are having a poor sleep quality; there exists a positive correlation between internet addiction and poor sleep quality among the students. Thus, a necessity for developing interventions and education strategies to reduce internet addiction to improve the sleep quality in students is indispensable.

**Keywords** Internet addiction · Sleep quality · Pittsburg sleep quality index · Orman's internet addiction test · Cross-sectional study · Bangladesh

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**Abbreviations**

| | |
|---|---|
| DCMC | Dhaka Community Medical College |
| CDC | City Dental College |
| OR | Odds ratio |
| CI | Confidence interval |
| SD | Standard deviation |

## Introduction

Internet addiction has become a major behavioral health problem along with advances in technologies. Internet addiction is a psychological dependence that varies from 0.3 to 8% in adolescents and 20% among adults [1–3]. Previous research studies have looked at the epidemiology of internet addiction in different regions of Asia where there have been a rapid change in the accessibility to the internet and the affordability of the

internet [4]. Anxiety, stress, and depression are the worst outcomes of internet addiction. 55% of subjects who are an abuser of the internet have a higher level of anxiety [5]. In China, 17.2% of adolescents had the criteria for problematic internet use, 40% were classified as suffering from sleep disturbance, and 54.4% had depressive signs [6].

Sleep has a significant function in human lives for both physical and mental health. Because of the growing body systems, the essentiality of sleep has a more substantial influence on a young generation. The estimated prevalence of sleep problems is 27–40% in young adults [7]. Among the issues outlined, difficulties in falling asleep and daytime sleepiness are one of the major issues [7, 8]. Excessive internet use is found to be the leading predictors of poor sleep quality and negligence to work. A study conducted in Korea with middle school students found less sleep time was significantly correlated with excessive internet use [9]. Sleep disorders are incredibly intricate, and one of the significant causes is pathological internet use that refers to excessive problematic internet use [10]. Several research studies have examined the sleep quality of individuals who are diagnosed with internet addiction [6, 11, 12]. In an earlier study, it was shown that students who spent excessive time in internet surfing social networking websites and watching television are more likely to have higher chance to develop sleep problems as well as depressive symptoms [13].

In university students, especially among medical students sleep disorder is a significant concern, as they are at risk of sleep disorder due to intrinsic work-related stress and nighttime duties [14]. There are limited studies in Bangladesh that studied the issue of problematic internet use and its association with sleep quality. There has only been a recent publication in 2016 which highlighted the risk factors of problematic internet use and the associated psychological distress among graduate students [15]. In Bangladesh, there has not been any research on medical students, about the association of their sleep quality and internet uses. So, it is important to recognize how advances in technologies have affected middle-income developing countries such as Bangladesh. Given the gap above in the literature, our study aims to explore the association between internet addiction and sleep quality among medical students using a population-based cross-sectional study. We also aim to identify the social and behavioral determinants on sleep quality among medical students.

## Methodology

### Study setting and population

A population-based analytical cross-sectional study was conducted in Dhaka Community Medical College (DCMC) and City Dental College (CDC) located in Dhaka, from December 2017 to May 2018. We recruited individuals if they met the inclusion criteria which are the following: (1) age from 18 to 26 years old, (2) regular medical students residing in Bangladesh, (3) having access to an email account or a social networking site and (4) were actively using the internet. Individuals who have had pre-existing medical disorders were excluded from the current study.

### Data

We used a convenient sampling technique to recruit our study participants. The target population was a total of about 520 students from both DCMC and CDC. We conducted a population-based cross-sectional survey of the students and collected data from 390 students. Among the other 130 students, some of them declined to give the interview or were absent in the institute during the survey. An interview was designed by a semi-structured questionnaire to collect information on age, sex (male or female), marital status (married/single), place of residence during class (living with family at home/dormitory), parent's monthly income ($\geq$ 50,000 or $<$ 50,000BDT), father's occupation, mother's occupation, number of siblings, came from (urban/rural), internet access at home or dormitory (yes/no), own a device (yes/no), main internet browsing device (cell/laptop/desktop/tab), smoking (yes/no), physical activities or sports (regular/irregular), brushing of teeth before sleep (yes/no). Any question or confusion from the students was clarified to ensure that every student understood all the questions during the survey.

### Pittsburg sleep quality index

The Pittsburgh sleep quality index (PSQI) is a useful instrument to measure the quality and patterns of sleep in adults. It differentiates sleep quality into 2 classes "poor" and "good" by measuring seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month. A total score of greater than 5 is indicative of poor sleep quality [16].

### Internet addiction test

Orman's Internet Addiction Survey (OIAS) is a test made up of 9 questions with "Yes" or "No" answers. Following the Orman's Internet Addiction Survey, the level of internet addiction was determined by adding the total number of "Yes" answers in these to nine questions that make up the test. A number above 7 indicates severe internet addiction; 3 points or below would show an absolute absence of dependence; while an intermediate score from 4 to 6 points suggests that the student has a moderate internet addiction. A score

of '4' indicates the person may or may not tend to become addicted to the internet; a score of '5' or '6' indicates the person has a greater chance of developing an addiction to the internet. Recently, Malts also recommended the use of Orman test in a study to define the internet addiction.

### Statistical analysis

After collection of data, all interviewed questionnaires were checked for completeness, correctness, and internal consistency. Statistical analysis of the data was conducted using software R. Basic descriptive statistics (chart diagram, frequencies, and percentage) were used to describe the categorical variables and means for continuous variables. Adjusted odds ratio, chi-square test, and their 95% confidence intervals were used as indicators of the strength of association. Multivariate logistic regression was also used in the analysis, to identify factors associated with sleep quality. For the level of statistical significance, we set our $p$ value to $\leq 0.05$.

## Results

The data are comprised of 390 medical students aged 18–26 years of which 157 were male, and 233 were female students. Figure 1 presents the percentage of students at levels of sleep quality among the different levels of Internet addiction. Among the participants, we found 19.3% are severely internet addicted, 49.2% have the moderate internet addiction and 31.5% with no internet addiction. It also shows that 30.5% students have good sleep quality among the participants. It appears from the figure that as the internet addiction increases the percentage of good sleep quality is decreasing.

The results of the unadjusted analysis by the chi-squared test are given in the Table 1. It indicates that internet addiction, residence during class, smoking and brushing teeth before sleep are significantly associated with the sleep quality at 5% significance level.

We fitted a multivariate logistic regression model for the level of sleep quality and the adjusted odds ratios (ORs) are given in the Table 2. It appears that the smoking habit of the students is working as a protective factor for their good sleep quality, which means students who are smokers are 76% less likely to have a good sleep quality than non-smoker students (OR = 0.24, CI 0.094–0.562). The model also indicates that students who have moderate and severe internet addiction are more at odds of having poor sleep quality more than who do not have any Internet addiction (OR = 0.24; $p \leq 0.001$ and OR = 0.05; $p \leq 0.001$). It also appeared that the students who are living with family during the class have 1.74 times more good sleep quality level compared to who are living

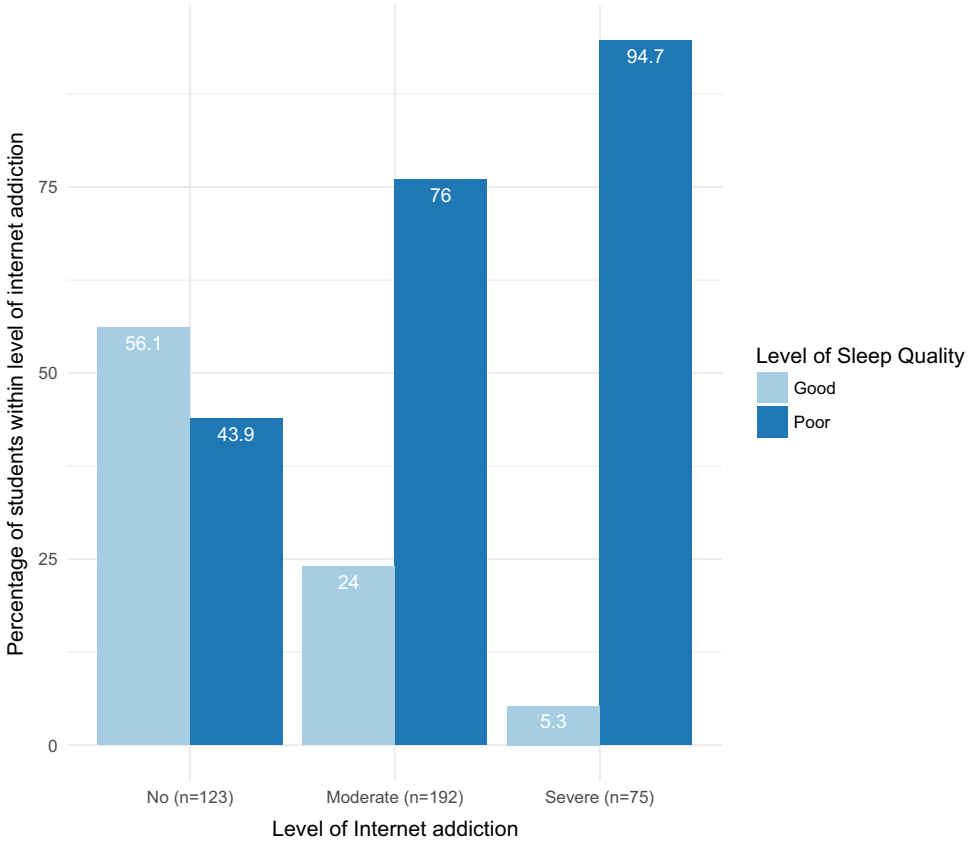


**Fig. 1** Percentage of students at levels of sleep quality among the three levels of internet addiction

**Table 1** Unadjusted analysis of socio-demographic characteristics of medical students

| Variables | Categories | Sleep quality | | Chi-square value | *p* value |
|---|---|---|---|---|---|
| | | Good | Poor | | |
| Sex | Male | 45 (28.7%) | 112 (71.3%) | 0.29 | 0.589 |
| | Female | 74 (31.8%) | 159 (68.2%) | | |
| Residence during class | Dormitory | 40 (25.9%) | 122 (75.3%) | 3.97 | **0.046** |
| | With family at home | 79 (33.4%) | 149 (65.4%) | | |
| Father occupation | Business | 33 (24.8%) | 100 (75.2%) | 3.11 | 0.211 |
| | In service | 65 (33.7%) | 128 (66.3%) | | |
| | Unemployed | 21 (32.8%) | 43 (67.2%) | | |
| Mother occupation | Employed | 38 (35.5%) | 69 (64.5%) | 1.43 | 0.232 |
| | Housewife | 81 (28.6%) | 202 (71.4%) | | |
| Monthly family income | ≤ 50,000 taka | 66 (32.7%) | 136 (67.3%) | 0.72 | 0.395 |
| | > 50,000 taka | 53 (28.1%) | 135 (71.9%) | | |
| Number of siblings | ≥ 2 | 71 (28.4%) | 179 (71.6%) | 1.20 | 0.273 |
| | 0–1 | 48 (34.2%) | 92 (65.8%) | | |
| Own a laptop | No | 37 (35.0%) | 69 (65.0%) | 1.06 | 0.304 |
| | Yes | 82 (28.9%) | 202 (71.1%) | | |
| Main internet browsing device | Cell | 99 (32.2%) | 208 (67.8%) | 1.68 | 0.195 |
| | Computer, etc. | 20 (24.0%) | 63 (76.0%) | | |
| Smoking | No | 109 (33.5%) | 216 (66.5%) | 7.58 | **0.006** |
| | Yes | 10 (15.3%) | 55 (84.7%) | | |
| Physical activities | No | 66 (28.5%) | 173 (72.4%) | 2.10 | 0.146 |
| | Yes | 53 (33.3%) | 98 (64.9%) | | |
| Brush teeth before sleep | No | 23 (21.2%) | 93 (80.2%) | 8.19 | **0.004** |
| | Yes | 96 (34.0%) | 178 (65.0%) | | |
| Level of internet addiction | Moderate | 46 (24.0%) | 146 (76.0%) | 64.30 | < **0.001** |
| | No | 69 (56.0%) | 54 (44.0%) | | |
| | Severe | 4 (5.3%) | 71 (94.7%) | | |

Bold values indicate significant variables at 5% significance level

**Table 2** Adjusted relationship between covariates and good sleep quality using multivariate logistic regression

| Variables | Reference | Odds ratio | Lower limit | Upper limit | *p* value |
|---|---|---|---|---|---|
| Sex (Male) | Female | 1.22 | 0.672 | 2.209 | 0.514 |
| Residence during class—with family at home | Dormitory | 1.74 | 1.024 | 3.011 | **0.042** |
| Father occupation | | | | | |
| Business | Unemployed | 0.64 | 0.284 | 1.423 | 0.269 |
| In official services | Unemployed | 1.02 | 0.491 | 2.147 | 0.958 |
| Mother occupation (house wife) | Employed | 0.54 | 0.292 | 1.000 | **0.051** |
| Monthly income (> 50,000) | ≤ 50,000 | 0.78 | 0.442 | 1.314 | 0.393 |
| Number of siblings (0–1) | ≥ 2 | 1.36 | 0.799 | 2.334 | 0.253 |
| Own a laptop (Yes) | No | 0.54 | 0.288 | 1.008 | **0.054** |
| Main internet browsing device (computer, etc.) | Cell | 0.96 | 0.472 | 1.921 | 0.910 |
| Smoker (Yes) | No | 0.24 | 0.094 | 0.562 | **0.002** |
| Physical activities (Yes) | No | 1.59 | 0.926 | 2.737 | 0.092 |
| Brush teeth before sleep (Yes) | No | 2.06 | 1.125 | 3.877 | **0.021** |
| Level of internet addiction | | | | | |
| Moderate | No | 0.25 | 0.143 | 0.417 | < **0.001** |
| Severe | No | 0.05 | 0.013 | 0.118 | < **0.001** |

Bold values indicate significant variables at 5% significance level

in the dorms with friends (OR = 1.74, CI 1.024–3.011). Students who do physical activities regularly have 1.59 times more good sleep quality than who do not perform physical activities (OR = 1.59, CI 0.926–2.737). It also shows that students who brush teeth before sleep are more likely to have 2.06 times more good sleep quality level compared to the students who do not brush teeth before sleep (OR = 2.06, CI 1.125–3.877).

## Discussions

The objective of the study is to find the proportion of students having good sleep quality and identify the social and behavioral determinants on sleep quality among medical students. In the study, we have found 69.5% of the students had poor sleep quality; this result is similar to another interventional study conducted among university students, where 71% of their participants reported for insomnia [17]. The prevalence of internet addiction found in this study (49.2%) is higher than the rates obtained from other university samples of similar age groups from Muslim majority countries such as Iran (39.6%) and Jordan (40.0%) [18, 19]. When both moderate and severely addicted users of the internet are incorporated, the proportion becomes 68.5%, which is much higher than what we expected. The adjusted logistic regression analysis indicates that as the internet addiction increases the level of poor sleep quality increases. Previous studies conducted on adolescents' sleep problems indicated that internet addiction has a close association with sleep disturbance. There was a study conducted among Turkish high school students, where their study findings indicated an association between the internet addiction and impaired sleep [20]. There was another study which was conducted in 7 European countries have found that the prevalence of sleep problems is higher among internet-addicted student, and excessive internet use could affect our health indirectly through lack of sleep [21]. There have been prior studies that have reported that students with poor sleep quality and internet addictions have negative influences on their daily life, academic performances, and relationship with friends and family [9, 22].

Our study findings show that the proportion of poor sleep quality among male medical students was higher than female students though the variable is not significant. A Turkish study found the prevalence of poor sleep quality for male students higher than female students [23]. We have seen that the students whose mothers are involved in service are more likely to have good sleep quality than the unemployed mothers. It could be the case because employed mothers tend to be more educated than those are a housewife, and because of their higher educational status employed mothers may teach their children a disciplined sleep routine from an early stage of their age. A study conducted in seven European countries has also reported a similar type of results [21]. A few studies reported that high family income level is responsible for internet addiction as well as poor sleep quality, which is also proved correct for our research although there is no strong significance [24, 25].

Our study also found that non-smokers had better sleep quality than smokers in the regression model. A research study conducted in Taiwan has found that students with smoking habit altered the regular sleeping pattern and are less likely to have good sleep quality [26]. Similar results are also found with Japanese adolescents [27]. Another longitudinal study conducted in New York has found out that heavy smoking contributes to insomnia [28]. Along with that our study also revealed that physically active students are 61% more likely to have good sleep quality than physically inactive students. In a study conducted among Korean adolescents has shown that a higher level of sleep satisfaction and lower level of stress were found among physically active subjects than physically inactive subjects [29]. Our study has also observed a unique association between the behavior of brushing teeth and sleep quality. Our study findings showed that students who brush teeth before sleep are 2.06 times more of having a good sleep quality than who do not brush their teeth before sleep.

The strengths of our study are that we have managed to determine both the proportion of internet addiction and sleep quality among the medical students that we have included in our study, where other studies conducted in our country are limited by the fact that they only assessed the prevalence of internet addiction. Another strength of this study is we used a validated questionnaire as the Pittsburg sleep quality index to determine the severity of the underlying sleep disturbance objectively. Despite the strength of our research, we do acknowledge we have only managed to elucidate the association between internet addictions and sleep quality, but not causality due to our research methodology. Our research study is only exploratory and aims to highlight the relationship between internet addictions and sleep quality.

## Conclusion

The current study is one of the few studies to determine not only the prevalence of internet addiction in a Bangladeshi cohort of youths but also their associated sleep quality. This study demonstrated that there is a positive correlation between internet addiction and poor sleep quality among students. Thus, a necessity for developing interventions and education strategies aiming the promotion of good sleep quality habits in students is indispensable. Moreover, screening of internet addiction among students should be performed and a large number of awakening programs

should be arranged to control internet usage and improve the sleep quality of students.

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**Author contributions** SMJ and SRH participated in study conception, design and coordination, data interpretation and drafted the manuscript. UBS, TR and AW reviewed the manuscript and helped to draft the manuscript. AH contributed in study conception, design, performed statistical analysis and helped to draft the manuscript. All authors approved of the final manuscript.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no competing interests.

**Ethical approval** Ethical approval for the study protocol was obtained from the North South University Review Committee and the two medical colleges.

**Informed consent** A written informed consent was obtained from all the study participants.

**Availability of data** Click here for the data file http://individual.utoronto.ca/ahmed_3/index_files/data/data.html.

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