Frequency and Predictors of Sleep Disorders in Undergraduate Medical Students

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ABSTRACT

OBJECTIVE: To assess frequency of sleep disorders among the medical students and to explore the association between different predictors and sleep disorders among the medical students.

METHODOLOGY: This cross-sectional study was conducted from September 2016 to December 2017 at Liaquat National Medical College Karachi, Pakistan. The study used 31% as prevalence of poor quality of sleep among medical students in Pakistan as identified in a previous research and 95% confidence level. The largest sample size calculated was n= 329. To adjust for the 10% expected non-response from some students, the final sample size was increased to 360 medical students. Non-probability purposive sampling technique was employed to recruit medical students. Students having systemic diseases, clinically diagnosed psychiatric problems and addiction, or those who refused to be part of the research were excluded. Internationally validated questionnaires were used for data collection which included Insomnia Severity Index, Depression Anxiety Stress Scale, Berlin Questionnaire and Epworth Sleepiness Scale.

RESULTS: Mean age of students was 21.98 years. Majority of them were females. Over 50% of students used internet more than 4 hours daily. One-third 36.3% (131) medical students obtained higher than normal scores on stress scale and 46% (167) on anxiety scale. The frequencies of students on risk of sleep disorders were as; day-time sleepiness 34%, obstructive sleep apnea 20% and insomnia 17%. The predictors of sleep disorders were male gender, excessive internet use and anxiety.

CONCLUSION: The considerable frequency of medical students is at risk of developing sleep disorders. The likelihood is more for male students and excess internet use.

KEYWORDS: Sleep disorders, Predictors, Undergraduate, Medical students

INTRODUCTION

Over the last three decades a significant change has been observed in the sleep pattern of student[1]. There has been an increase in the frequency of students suffering from sleep disorders, resulting in a drop in the quality and duration of sleep[2,3]. Medical students, in particular, have more sleep disorders. They have to encounter the extensive medical curriculum and demanding academic activities. Frequent assessments, long working hours, varying clinical rotations and lack of leisure time make sleep a lower priority for these students[4].

In addition to it, the day to day exposure of human sufferings and deaths in their clinical settings predispose medical students to higher burden of stress and anxiety[5]. Previous studies report a higher prevalence of stress and anxiety among medical students compared to the general population[6,7]. Prevalence of stress among medical students was reported to be 47% in Brazil[8], 60% in Egypt[9] and 63% in Saudi Arabia[10]. Rizvi F 2015[11] accounted the prevalence of stress and anxiety among Pakistani medical students as 50% and 74.2%, respectively. Stress and anxiety among these students results in various sleep disorders which may lead to negative outcomes on their academic performances.

Sleep disorders are also strongly linked with lifestyle practices including excessive use of mobile phones and internet for socializing or learning purposes[12]. Over use of technology impede college students from obtaining sufficient sleep[13], subsequently increasing the risk of insomnia, daytime sleepiness and poor sleep quality[14,15]. There are serious consequences of sleep disorders among the students. The risk of acquiring various psychiatric illnesses and medical problems including hypertension, obesity, insulin resistance and diabetes are high in later life[1,16]. There is a need to timely identify the students at a risk of developing sleep disorders and create awareness regarding good sleep practices. This would result in directing their potentials towards highest level of knowledge and enabling them to flourish in their academic activities.

In Pakistan, previous literature has identified poor quality of sleep among medical students[17] and the effect of sleep pattern on academic achievements[18]. However, there is inadequacy of literature regarding the specific types and the possible predictors of sleep disorders among medical students, which gave way to explore such associations, through a cross sectional survey. The aim of this study was to identify the

medical students at risk of developing sleep disorders namely insomnia, obstructive sleep apnea and day time sleepiness. Furthermore, it also aimed to to explore the associations between different predictors and sleep disorders among the medical students.

METHODOLOGY

This cross-sectional study was conducted from September 2016 to December 2017. The study participants comprised of undergraduate medical students enrolled in first to final years of the five-year Bachelor of Medicine and Bachelor of Surgery (MBBS) degree program at Liaquat National Medical College Karachi, Pakistan. Open Epi software version 3.01 was used for sample size calculation. The study used 31% as prevalence of poor quality of sleep among medical students in Pakistan as identified in a previous research[19] and 95% confidence level. The largest sample size calculated was n= 329. To adjust for the 10% expected non-response from some students, the final sample size was increased to 360 medical students. Non-probability purposive sampling technique was employed to recruit medical students. Students having systemic diseases, clinically diagnosed psychiatric problems and addiction, or those who refused to be part of the research were excluded.

The data was collected using a structured questionnaire administered by trained data collectors. Four internationally validated and reliable questionnaires, namely the Berlin Questionnaire (BQ), the Insomnia Severity Index (ISI), the Depression Anxiety Stress Scales (DASS) and the Epworth Sleepiness Scale (ESS) were employed to identify the students at risk of developing the above-mentioned sleep disorders. The socio-demographic characteristics of students and their lifestyle were recorded in a separate questionnaire. Self-reported internet use and academic performance wereas recorded. It took around 20 to 25 minutes to complete an interview. The nature and purpose of the study were explained to participants in detail. A written informed consent was taken from the study participants. The students who were identified at risk of any of the sleep disorders were referred to consultants.

Considering descriptive statistics, for continuous type of socio-demographic variables, we used mean and standard deviations. Frequencies with percentages were used for categorical variables. We used cross tabs in order to assess the percentages of students who had stress and anxiety, and were at risk of hypersomnia, insomnia and apnea. In order to address the confounders in the study, univariate and multivariate logistic regression analysis was employed. This helped us in determining the unadjusted and adjusted relationships between predictor (age, gender, education, stress, anxiety, internet use and academic performance) and outcome variables (Sleep disorders i.e. insomnia, day-time sleepiness and obstructive sleep apnea). The p-value of <0.05 was considered to be statistically significant. SPSS version 22 software was used for data analysis. The protocol of the study was approved by Ethical Review Committee of Liaquat National Hospital and Medical College Karachi.

Anxiety, stress, insomnia, obstructive sleep apnea and day-time sleepiness were defined by using the following standard questionnaires:

Anxiety and Stress:
The Depression, Stress and Anxiety scale (DASS) was used to identify the students at risk of stress and anxiety. It was a 42-item questionnaire designed to measure depression, anxiety and stress. Each of the three scales contains 14 items, divided into subscales of 2-5 items with similar content. Only the Anxiety and Stress scales of this questionnaire were used for this study. Scores of anxiety and stress were calculated by summing the scores for the relevant items[20]. The following cut-off scores were used for anxiety: normal 0-3, mild 4-5, moderate 7-10, severe 11-13 and extremely severe 10+; and the cutoff scores for stress were: normal 0-7, mild 8-9, moderate 10-12, severe 13-16 and extremely severe 17+.

Insomnia:
Insomnia Severity Index (ISI) was used to identify the students at risk of developing insomnia. The ISI is a 7-item self-report questionnaire. The 5-point likert scale is used to rate each item (0 to 4, where 0 indicates no problem and 4 indicates very severe problem), yielding a total score ranging from 0 to 28. Clinically significant insomnia was detected when the total score was >142[21].

Obstructive sleep apnea:
Berlin Questionnaire (BQ) was used as a screening tool for Obstructive sleep apnea. Students who had a positive score on two or more categories were considered at high risk for obstructive sleep apnea[22].

Day-time sleepiness:
The Epworth Sleepiness Scale (ESS) was used as a screening tool of day-time sleepiness. A sum of 9 or more scores on this scale was specified as significant day-time sleepiness[23].

RESULTS

The mean age of the undergraduate medical students was 21.98 years (SD = 1.7 years) and a majority (249) of them were females (69%). Almost 58% (210) of the students were using internet for more than 4 hours daily, with slight difference between female and male students (60% vs. 56%, respectively). Over one-third (131) of the students obtained higher scores on stress scale. The female students had higher stress scores than males (37.8% vs. 32.3% respectively). The percentage of students whose scores were above

normal range on anxiety scale was 46.4%, of which 17% had severe anxiety. More than two-thirds (252/70%) of the undergraduate medical students perceived that internet usage was affecting their academic performance. Overall, 34% (124) of the students scored far above the normal range for day-time sleepiness, 20% (74) for obstructive sleep apnea and 17 % (62) for insomnia (**Table I**).

Hypersomnia among the Medical students having anxiety and stress. Around 47% of the students having anxiety were at risk of hypersomnia. Similarly, 47% of the students having stress had risk of hypersomnia.

Apnea among the Medical students having anxiety and stress. Around 30% of students who had anxiety were at risk of having apnea, while 25% of students having stress had a risk of having apnea.

Insomnia among the Medical students having anxiety and stress, 25% of the students who had anxiety were at risk of having insomnia, while 28% of the students who were stressed had a risk of anxiety.

Table II shows the Logistic Regression analysis on association of obstructive sleep apnea with independent variables. On univariate analysis, age, gender, internet use, high scores on stress and anxiety scale were found to be significantly associated (p-value <0.05) with obstructive sleep apnea.

Multivariable logistic regression analysis showed 37% increased risk of having obstructive sleep apnea, with one year increase in the age of the student (OR: 1.37; 95% CI: 1.01-1.85). Male students had 3.5 times higher risk of developing obstructive sleep apnea (95% CI: 1.85-6.66). Students using internet for 4 to 8 hours daily were more likely to have obstructive sleep apnea (OR: 2.4, 95% CI: 1.14 - 5.08). In addition, a strong association was observed between obstructive sleep apnea and mild anxiety (OR: 3.44, 95% CI: 1.47- 8.07).

Table III shows the logistic regression analysis on association of independent factors with day-time sleepiness. The mutivariable model showed a significant association between extremely severe anxiety (OR: 3.58, 95% CI: 1.14 -11.26) and day-time sleepiness. The students in third year of undergraduate medical education had 3.1 times higher risk of day-time sleepiness as compared to their fellows. Also, the students who perceived that internet use is affecting their academic performance showed a strong association with day-time sleepiness.

Table IV shows the logistic regression analysis on association of insomnia with the independent factors. The multivariate regression model showed the considerable impact of more than 12 hours daily internet use (OR: 5.20, 95% CI: 1.66 – 16.26) on insomnia. Furthermore, the students who perceived that their academic performance is frequently affected by internet use were 5 times more likely to suffer from insomnia (95% CI: 1.69 – 14.82).

TABLE I: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF UNDERGRADUATE MEDICAL STUDENTS IN KARACHI, PAKISTAN (n= 360)

Variable	n (%)
Age (years) Mean (SD)[a]	21.98 (1.72)
Gender	
Male	111(30.8%)
Female	249(69.2%)
Educational year in medical college	
First	31(8.6%)
Second	79(21.9%)
Third	84(23.3%)
Fourth	79(21.9%)
Fifth	87(24.2%)
Time spent on internet use/ day	
<4 hours	150(41.7%)
4-8 hours	139(38.6%)
>8-12 hours	49(13.6%)
>12 hours	22(6.1%)
Stress score (DASS)	
Normal	229(63.6%)
Mild	53(14.7%)
Moderate	52(14.4%)
Severe	17(4.7%)
Extremely Severe	9(2.5%)
Anxiety score (DASS)	
Normal	193(53.6%)
Mild	54(15%)
Moderate	50(13.9%)
Severe	32(8.9%)
Extremely Severe	31(8.6%)
Obstructive Sleep Apnea	
Yes	74(20.6%)
No	286(79.4%)
Insomnia (ISI scale)	
Yes	62(17.2%)
No	298(82.8%)
Day-time sleepiness (ESS scale)	
Yes	124(34.4%)
No	236(65.6%)
Self perceived effect on academic performance	
Not at all	108(30%)
Sometimes	131(36.4%)
Frequently	57(15.8%)
Very frequently	64(17.8%)

a = SD = Standard Deviation

TABLE II: LOGISTIC REGRESSION ANALYSIS FOR THE ASSOCIATION OF OBSTRUCTIVE SLEEP APNEA WITH INDEPENDENT VARIABLES

Obstructive Sleep apnea OR (95% CI) $^{\alpha}$		
	Unadjusted	Adjusted
Age (years)	1.18(1.02-1.37)[*]	1.37(1.01-1.85)[*]
Gender		
Female	1	
Male	3.08(1.81-5.22)[***]	3.52(1.85-6.66)[***]
Medical college year		
First	1	1
Second	1.20(0.35-4.08)	1.19(0.26-5.09)
Third	2.86(0.90-9.02)	2.61(056-12.14)
Fourth	1.45(0.43-4.8)	0.69(0.12-3.71)
Fifth	1.88(0.58-6.05)	0.71(0.10-4.65)
Number of hours students spent on internet		
Less than 4 hours	1	1
4 to 8 hours	2.06(1.10-3.84)[*]	2.41(1.14-5.08)[*]
8 to 12 hours	2.75(1.25-6.04)[*]	1.74(0.63-4.79)
More than 12 hours	4.77(1.79-2.67)[**]	2.92(0.88-9.61)
Stress level		
Nil	1	1
Mild	0.93(0.42-2.07)	0.55(0.20-1.47)
Moderate	1.23(0.58-2.59)	0.21(0.06-0.74)[*]
Severe	5.15(1.87-14.17)[**]	0.75(0.15-3.73)
Extremely severe	3.66(0.94-14.25)	0.22(0.02-1.77)
Anxiety level		
Nil	1	1
Mild	2.7 (1.3-5.63)[**]	3.44(1.47-8.07)[**]
Moderate	1.14 (0.46-2.83)	1.38(0.45-4.20)
Severe	1.97 (0.77-5.05)	1.69(0.47-5.99)
Extremely severe	14.78 (6.22-35.15)[***]	32.01 (7.45-137.42)[***]
Self perceived effect on academic performance		
Not at all	1	1
Sometimes	1.39(0.68-2.80)	1.09(0.48-2.47)
Frequently	2.21(0.99-4.94)	1.99(0.72-5.48)
Very frequently	2.81(1.31-6.02)[**]	1.68(0.59-4.77)

[*]p-value = < 0.05, [**]p-value = < 0.01, [***]p-value = < 0.001, $^{\alpha}$OR = odds ratio, CI = confidence interval

TABLE III: LOGISTIC REGRESSION ANALYSIS FOR THE ASSOCIATION OF DAY-TIME SLEEPINESS WITH INDEPENDENT VARIABLES

Day-time sleepiness OR (95% CI) $^{\alpha}$		
	Unadjusted	Adjusted
Age (years)	0.93(0.82-1.06)	0.87(0.68-1.12)
Gender		
Female	1	
Male	1.10(0.69 1.76)	1.23(0.71-2.13)
Medical college year		
First	1	1
Second	1.87(0.73-4.67)	1.99(0.73-5.44)
Third	2.49(1.00-6.2)[*]	3.14(1.03-9.61)[*]
Fourth	0.91(0.35-2.3)	1.71(0.49-6.13)
Fifth	1.29(0.51-3.25)	3.26(0.76-13.93)
Number of hours students spent on internet		
Less than 4 hours	1	1
4 to 8 hours	1.15(0.70-1.90)	0.96(0.54-1.70)
8 to 12 hours	1.80(0.92-3.51)	1.02(0.47-2.20)
More than 12 hours	4.21(1.65-10.76)[**]	2.39(0.83-6.82)
Stress level		
Nil	1	1
Mild	1.91(1.02-3.55)[*]	0.98(0.46-2.11)
Moderate	2.69(1.45-4.99)[**]	0.84(0.36-1.93)
Severe	3.03(1.11-8.20)[*]	0.62(0.17-2.19)
Extremely severe	3.36(0.87-12.94)	0.54(0.10-2.84)
Anxiety level		
Nil	1	1
Mild	1.59(0.83-3.07)	1.18(0.56-2.47)
Moderate	2.72(1.42-5.20)[**]	1.66(0.74-3.74)
Severe	4.10(1.89-8.90)[***]	2.29(0.85-6.16)
Extremely severe	5.06(2.28-11.20)[***]	3.58(1.14-1.26)[*]
Self perceived effect on academic performance		
Not at all	1	1
Sometimes	3.4(1.73-6.84)[***]	3.30(1.60-6.81)[**]
Frequently	10.80(4.92-23.68)[***]	9.53(4.03-22.51)[***]
Very frequently	8.82(4.12-18.86)[***]	5.85(2.42-14.14)[***]

[*]p-value = < 0.05, [**]p-value = < 0.01, [***]p-value = < 0.001, $^{\alpha}$OR = odds ratio, CI = confidence interval

DISCUSSION

The study sample comprised of the students from all five years of undergraduate medical college. Almost 70% of the students were females. This increasing induction of female students in medical colleges has also been observed by Surani AA et al[19]. Over the years it is a remarkable observation in Pakistan that the female students are performing better in competitive exams and they acquire more seats in degree programs as compared to male students.

This study identified that 58% of the students were using internet for more than 4 hours daily. There is increased in ownership of smart phones and personal computers among the students. Students frequently get involved in internet-based activities after dinner and late night for online games, social media and

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TABLE IV: LOGISTIC REGRESSION ANALYSIS FOR THE ASSOCIATION OF INSOMNIA WITH INDEPENDENT VARIABLES

	Insomnia OR (95% CI) [α]	
	Unadjusted	**Adjusted**
Age (years)	1.02(0.87-1.19)	1.15(0.83-1.60)
Gender		
Female	1	1
Male	1.40(0.79-2.49)	1.42(0.71-2.83)
Medical college year		
First	1	1
Second	2.95(0.80-10.81)	2.54(0.60-10.67)
Third	2.19(0.59-8.13)	1.76(0.33-8.76)
Fourth	1.20(0.30-4.76)	0.91(0.15-5.57)
Fifth	1.94(0.52-7.23)	1.32(0.17-10.09)
Number of hours students spent on internet		
Less than 4 hours	1	1
4 to 8 hours	1.09(0.55-2.16)	1.11(0.51-2.39)
8 to 12 hours	1.99 (0.87-4.55)	1.37(0.53-3.57)
More than 12 hours	9.95(3.75-26.44)[***]	5.20(1.66-16.26)[**]
Stress level		
Nil	1	1
Mild	1.45(0.61-3.42)	0.79(0.27-2.30)
Moderate	3.62(1.76-7.45)[***]	1.77(0.65-4.84)
Severe	4.45(1.51-13.08)[**]	1.24(0.28-5.42)
Extremely severe	28.56(5.62-45.10)[***]	7.18(0.90-17.00)
Anxiety level		
Nil	1	1
Mild	0.88(0.31-2.47)	0.55(0.17-1.77)
Moderate	3.70(1.73-7.94)[**]	1.88(0.70-5.03)
Severe	1.99(0.73-5.43)	0.61(0.15-2.43)
Extremely severe	9.22(3.97-21.43)[***]	1.95(0.50-7.57)
Self perceived effect on academic performance		
Not at all	1	1
Sometimes	1.61(0.65-3.97)	1.30(0.48-3.52)
Frequently	2.98(1.12-7.92)[*]	2.16(0.71-6.60)[**]
Very frequently	9.72(4.06-23.28)[***]	5.01(1.69-14.82)[**]

[*] p-value = < 0.05, [**] p-value = < 0.01, [***] p-value = < 0.001,
[α] OR = odds ratio, CI = confidence interval

other related purposes[1].

The medical students scored high for stress (36%) and anxiety (46%) which were, however, lower when compared to the findings of Rizvi F 2015[11]. This could be because our study sample comprised of students from a private medical college in contrast to the reported study conducted on students from both private as well as public medical colleges. Students in private medical colleges come across less economical problems and responsibilities as compared to the students of public institutions. Given that they are able to afford the annual and/semester fee and are known to belong to higher socio-economic statuses. Such financial pressures have been identified as the reason of stress and anxiety among students by Altaf M 2013[24].

The study identified 20% of students were at risk of obstructive sleep apnea, 17 % for insomnia and 34% for day-time sleepiness. The literature shows that sleep disorders are frequent among medical students[16]. About 40% of medical students in Pakistan were identified as poor sleepers by Surani AA et al[19]. The previous studies identified the relationship of poor sleep with physical environment, economy and academic grades. Similar to the literature[25], in this study obstructive sleep apnea was found to be higher among male students.

Almost 33% of students in this sample reported their academic performance being frequently affected by excessive use of internet. Their poor academic performance was also strongly associated with risk of getting sleep disorders particularly insomnia and day-time sleepiness, similar findings were obtained by Haile YG 2017[26] in Ethiopia. Similar to these findings, previous researchers also mentioned the strong association between increased duration of internet use and sleep disorders[27,28]. Excessive time spent on the internet leads to compromised sleep which ultimately affects the academic performance of students leading to the development of stress and anxiety[27].

One year increase in the age of the student resulted in a significant increase in obstructive sleep apnea. We found similar results among senior students of third year MBBS having a greater risk of day-time sleepiness. Lifespan changes in sleep quality are multifaceted, which are also dependent on academic and/or clinical responsibilities, as shown in a large survey study of Malaysian medical students[28]. Similarly, sleep and sleepiness was found to be worse for interns and postgraduate trainees, compared to medical students, according to an Indian study[29].

Multiple studies accessing gender differences in sleep quality have been shown to represent mixed results. In the earlier mentioned Indian study[29], sleep quality in females was better than in males, much like our study results. However, no significant associations were found between genders and sleep quality in an Iranian study[30].

Strengths:

We employed standardized and internationally validated questionnaires to identify the risk of getting stress, anxiety and sleep disorders among medical students. The sample comprised of students from all five years of the MBBS teaching program.

Limitations:

The study sample was taken from a single medical

college so the study results cannot be generalized. It is a private medical college where students belong to upper socioeconomic status. Further researches are needed to understand sleep disorders among students belonging to public medical institutions. This study, being cross sectional in design cannot be inferred regarding the causality and temporality between stress, anxiety and sleeps disorders.

CONCLUSION

Sleep disorders are common among medical students and affect their academic performance. Internet use, stress and anxiety are strongly predictors of sleep disorders. There is a need to educate medical students regarding good sleep habits in order to avoid the development of psychiatric and medical problems in future.

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