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Evaluation of sleep quality and depressive symptoms among medical students during COVID-19 pandemic

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Abstract

Background Depression and sleep disorders are interrelated and have high prevalence. Based on previous findings, medical students experience high rates of depression and low sleep quality, due to the challenges during medical training programs. During the COVID-19 pandemic, medical students faced extra physical and psychological pressure. This study aimed to evaluate sleep quality and depressive symptoms and their possible association among medical students during COVID-19 pandemic.

Results One hundred twenty-one medical students completed the survey. Twenty-six percent of participants had a good sleep quality. Mean sleep duration of participants was approximately 6 h per day. Moreover, they had a mean sleep latency of 28 min and a mean PSQI score of 7.76. We found the prevalence of moderate, moderately severe, and severe depression among participants to be 22%, 6%, and 7%, respectively. The participants' mean PHQ-9 score was found to be 8.4.

Conclusions We found a relatively high depression rate, poor sleep quality, and a significant inverse relationship between sleep quality and depression severity score among medical students who were doing their clinical rotations during the COVID-19 pandemic. Additionally, quarter of moderate to severely depressed participants were taking antidepressants. Our findings highlight the need for future interventional studies that address these issues among medical students.

Keywords Sleep quality, Depression, Depressive symptoms, Medical students, COVID-19

Background

Sleep quality refers to an individual's satisfaction with sleep, including sleep quantity, continuity, and feeling of freshness upon awakening [1]. Sleep disorders are prevalent, with an estimated prevalence of 24% among the general population [2]. Sleep quality can be influenced by various factors such as age, gender, and socioeconomic status [3]. Poor sleep quality and insomnia are associated with a reduced quality of life and can lead to various mental health problems, including aggressiveness, memory impairment, and depression [4–8]. Depression is a common mental illness that is often comorbid and interrelated with sleep disorders [9–11].

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University students, particularly medical students, are disproportionately affected by mental health problems such as depression, sleep issues, and being burnt out [12–15]. Medical education programs typically require students to spend time in high-stress environments such as hospital wards and clinics, which can interfere with their sleep quality. Additionally, the COVID-19 pandemic has increased the physical and psychological pressures faced by medical students, leading to an increase in depression rates [16–19].

The purpose of this study is to assess sleep quality and depression rate and severity among medical students taking clinical rotations during the COVID-19 pandemic, the possible association between them, as well as the impact of factors such as gender, age, cigarette smoking, part-time jobs, and antidepressant medication administration.

Methods

Study design and participants

This cross-sectional study was conducted online from July to September 2021 during the fourth peak of COVID-19 in Iran. Informed consent was obtained from the participants through the questionnaire, where they agreed to the use of their data for research purposes. The study sample comprised 180 randomly chosen medical students who were spending their clinical clerkship or internship rotations with approximately 5 to 8 night shifts per month in the affiliated hospitals of the Tehran University of Medical Sciences. All the participants followed a schedule of mandatory (and in some cases, voluntary) COVID-19 shifts as required by the university. They also attended online lectures but were physically present for medical rounds in their assigned hospital wards. As a result, all participants had a history of being exposed to COVID-19 and had direct or indirect contact with infected patients. Students who did not respond to the questionnaire were excluded from the study. The final sample size was 121 participants who accurately completed the questionnaire.

Questionnaire

The online questionnaire included demographic information such as age, sex, and job status, as well as questions about cigarette smoking and the use of antidepressant drugs prescribed by a licensed psychiatrist. To assess sleep quality and depression, we used the Pittsburgh Sleep Quality Index (PSQI) and the Patient Health Questionnaire-9 (PHQ-9), respectively. The PSQI is a self-administered questionnaire summarizes 21 items about duration, consistency, and other aspects of sleep into 7 major components of sleep: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep

disturbance, use of hypnotic drugs, and daytime dysfunction. Each component is scored from 0 to 3, and a global score is calculated by summing the seven component scores. A cutoff point of 5 is to determine between those who sleep well from those who do not. We used the validated Persian version of PSQI [1, 20]. The PHQ-9 is a self-administered questionnaire that assesses the nine DSM-IV criteria for depression over the past 2 weeks [21, 22]. Each criterion is scored on a Likert scale ranging from 0 (not at all) to 3 (nearly every day), with a total score ranging from 0 to 27. A score of 10 or higher is indicative of depression. We used the Persian version of PHQ-9, which has been previously validated [23].

Data analysis

Data were analyzed using IBM SPSS version 22. Frequencies and percentages were used to describe categorical variables such as gender, age, part-time job, smoking cigarettes, and the use of antidepressant drugs. The mean and standard deviation were used to describe continuous variables such as PSQI and PHQ-9 scores. We employed independent samples *t* tests to examine the correlation between demographic variables and PSQI and PHQ-9 scores. Pearson's correlation test was used to assess the relationship between PHQ-9 and PSQI global scores. Statistical significance was considered at a *p*-value of less than 0.05.

Results

One hundred twenty-one students completed the survey of whom 65 (53.7%) were females. The mean age of the participants was 23.7 (SD: 1.6) years.

Mean global PSQI score of the participants was 7.76 (SD: 3.3). Mean sleep duration of the participants was 5:58' (SD: 1:18'), and the mean sleep latency was 28 min (SD: 24). Sixty-five percent of participants described their sleep quality as good or fairly good while according to the PSQI score, only 26% of participants had a good sleep quality. The average sleep duration for those who slept well was 6 h and 43 min, compared to 5 h 40 min for those who did not. The participants' sleep quality was related to the use of antidepressant drugs. Sleep quality was not related to gender or having part-time job.

There was a significant correlation between PSQI and PHQ-9 scores (*p* value < 0.005, Pearson's *r*: 0.55). Mean PHQ-9 score for good sleepers was 4.56 (SD: 4.11) and 9.77 (SD: 5.40) for those who did not have a good quality of sleep according to the PSQI score (*p* value < 0.005). Demographic information and PSQI components' scores for participants are shown in Table 1.

The mean PHQ-9 score among participants was 8.4 (SD: 5.5). The prevalence of mild, moderate, moderately severe, and severe depression among participants was

Table 1 Demographic information and sleep quality components' scores

	Total (N = 121) Mean (SD)	Male (N = 56) Mean (SD)	Female (N = 65) Mean (SD)	P value
Age	(1.6)23.7	23.8 (1.7)	23.6 (1.5)	0.866
Cigarettes smoking (N (%))	10 (8.3)	7 (12.5)	3 (4.6)	0.116
Antidepressant use (N (%))	23 (19.0)	8 (14.3)	15 (23.1)	0.219
Part time job (N (%))	41 (33.9)	25 (44.6)	16 (24.6)	0.02
PSQI > 5 (N (%))	90 (74.4)	40 (71.4)	50 (76.9)	0.264
PHQ-9 > 10 (N (%))	41 (33.9)	19 (33.9)	21 (32.3)	0.992
PSQI components				
Subjective sleep quality	1.31 (0.80)	1.27 (0.82)	1.34 (0.78)	0.628
Sleep latency	1.39 (0.93)	1.39 (0.97)	1.38 (0.90)	0.961
Sleep duration	1.57 (1.02)	1.55 (1.09)	1.55 (0.98)	0.999
Habitual sleep efficiency	0.33 (0.65)	0.28 (0.52)	0.38 (0.74)	0.378
Sleep disturbances	1.17 (0.49)	1.11 (0.53)	1.22 (0.45)	0.226
Use of sleep medication	0.43 (0.83)	0.46 (0.85)	0.40 (0.82)	0.675
Daytime dysfunction	1.55 (0.88)	1.38 (0.91)	1.71 (0.82)	0.037

N Number, SD Standard deviation, PSQI Pittsburgh sleep quality index, PHQ-9 Patient health questionnaire-9

39, 22, 6, and 7%, respectively. Additionally, 26% of participants did not experience depression or had minimal depression. Participants with moderately severe to severe depression had a higher PSQI score than those with minimal or mild depression (10.05 (SD: 3.47) and 6.59 (SD: 2.57), respectively, p value < 0.001). We also found a significant relationship between subjective sleep quality and PHQ-9 score (p value < 0.001). PSQI and PHQ-9 scores for participants are shown in Table 2.

The most prevalent symptom among PHQ-9 checklist was little interest in doing tasks. PHQ-9 checklist is summarized for good sleepers and bad sleepers in Fig. 1.

Discussion

We evaluated the sleep quality, depression rate, and their relationship among Iranian medical students in clinical rotations during the COVID-19 pandemic. We found that about one third of our participants suffer from depression. Only one out of four participants experienced a good sleep quality, and one out of four reported a healthy sleep duration of 7 h or more per day. We found a significant inverse correlation between sleep quality and depression severity among our participants.

Depression rate was almost equal between this study and previous reports of depression among medical students [24–26]. Our results on depression rate is also in line with a study that systematically reviewed reports of depression prevalence among medical students [27]. There was no considerable difference between our findings on depression rate among medical students during COVID-19 pandemic and the finding of previous studies conducted before the pandemic on Iranian university

Table 2 Comparison between study groups PSQI and PSQ-9 scores

	PSQI		PHQ-9	
	Mean (SD)	P value	Mean (SD)	P value
Sex		.409		.213
Male	7.48 (3.13)		7.77 (5.12)	
Female	7.98 (3.48)		9.02 (5.83)	
Cigarette smoking		.830		.100
Yes	7.90 (2.02)		12.40 (7.35)	
No	7.74 (3.42)		8.08 (5.23)	
Part time job		.935		.884
Yes	7.72 (2.86)		8.54 (5.06)	
No	7.77 (3.54)		8.39 (5.78)	
Antidepressant use		.004		.087
Yes	9.77 (3.39)		10.26 (5.52)	
No	7.30 (3.15)		8.01 (5.47)	
Subjective sleep quality		.000		.000
Good	4.40 (1.5)		3.73 (3.2)	
Almost good	6.64 (1.9)		7.05 (4.2)	
Almost bad	10.13 (2.6)		11.78 (2.0)	
Bad	13.60 (2.3)		13.70 (4.7)	

SD Standard deviation, PSQI Pittsburgh sleep quality index, PHQ-9 Patient health questionnaire-9

students [28]. Our findings also indicate equal and higher prevalence of depression and sleep disorders, respectively, among Iranian medical students compared to findings on the prevalence of these mental issues in medical students worldwide during COVID-19 pandemic, according to a systematic review [29]. Some of previous

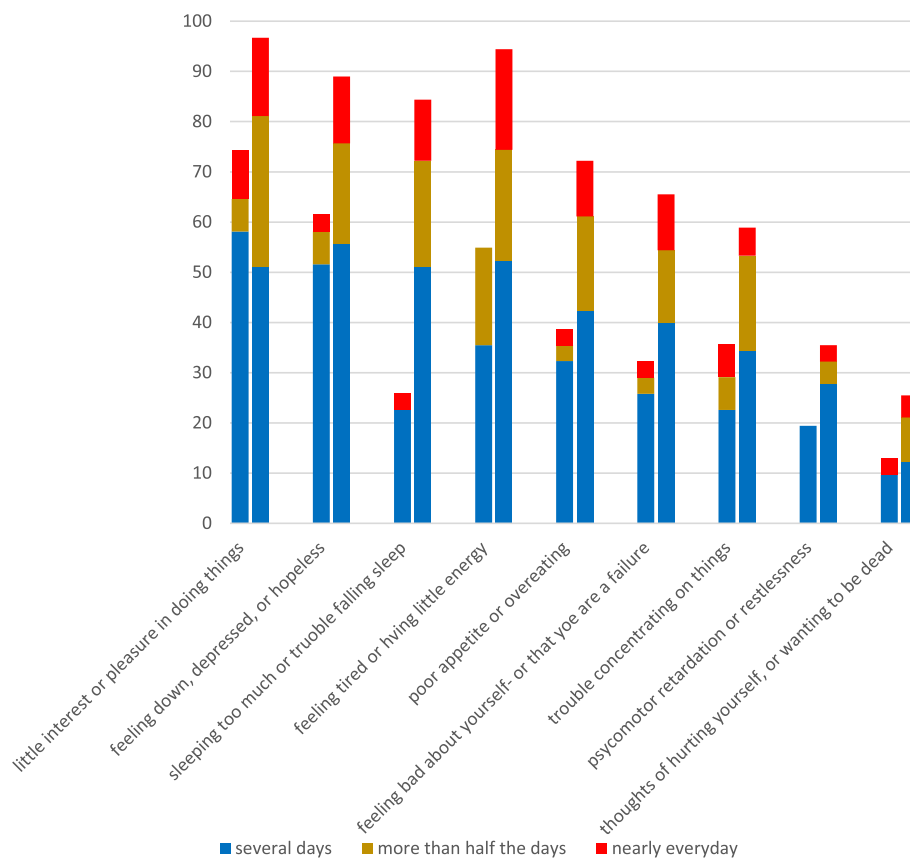


Fig. 1 Depressive symptoms experienced by participants with good sleep quality and participants with bad sleep quality in the past 2 weeks. In each pair of bars, the left one indicates the good sleepers and the other indicates bad sleepers. The vertical axis shows the percentage of the participants who experienced each of the symptoms

reports have indicated that they did not find a significant difference in depression rates among medical students before and after the pandemic [30, 31]. Possible reason for not finding a considerable difference in depression rates before and after the pandemic could be that the baseline rates of depression and poor sleep were already high among medical students even before the pandemic. It is well-established that medical students are at a high risk of developing depression due to the demanding nature of their academic and clinical training. Therefore, the pandemic could not significantly exacerbate the pre-existing rates of depression among medical students [30, 31]. This can be due to different methodologies of the studies included or different workloads of the medical students in different parts of the world, and a clear conclusion cannot be drawn. It is important to consider the study design, sample size, or measurement tools used in the studies when interpreting the results. One fourth of moderate to severely depressed participants in our study were using antidepressant drugs. This rate is almost in line with another study conducted by Guo et al. [32] which is suggestive of insufficient depression treatment.

Our findings regarding sleep quality is in line with a study conducted on middle eastern medical students which reported good sleep quality in approximately one third of their participants [33]. In our study, the depression score was two times higher in individuals with low-quality sleep. According to a previous study, insomnia is not only a common symptom of depression but also can be a strong predictor of depression in non-depressed individuals with insomnia [34]. The mechanisms behind this relationship is not fully understood. One hypothesis states that sleep disturbance can increase depression-related gene expression by inducing inflammatory factors [35, 36].

Twenty-five percent of participants reported using hypnotic pills during past month which was meaningfully higher than a study on Greek medical student that stated only 9% of them used sleeping pills [37], which raises concerns regarding policies taken in medical school training. Smoking ratio among our participants was 8% which was lower than other studies. A study reported 15% of medical student are cigarettes smokers [38]. In contrast to other studies [39, 40], we found no

significant relationship between cigarettes smoking and sleep quality or depression prevalence, although cigarette smokers had significantly higher PHQ-9 scores. However, it is worth mentioning that our findings could be limited by the small number of cigarette smokers in our sample.

Our study has several limitations. First, we used online self-report surveys, which could expose our findings to biases. Second, the PSQI measures sleep quality, not all sleep disorders. Other methods such as polysomnography can be utilized to investigate sleep disorders further. Third, we had no data regarding participants' past medical and psychiatric history. Moreover, our survey method reduced our ability to test for possible COVID-19 infection at the time of study, as well as duration and impact of antidepressant treatment on the individuals' symptoms. These variables could have had a confounding effect on our findings. Furthermore, advise using anxiety as a variable in further studies because it has been proven that anxiety has a significant relationship with sleep disorders and depression.

Conclusion

In conclusion, we found a higher rate for depression and sleep disorders among Iranian medical students in their clinical rotations during the COVID-19 pandemic compared to their peers worldwide. Poor sleep quality and depression were correlated. Our findings reinforce the importance of taking policies that could improve mental health conditions among medical students.

Abbreviations

PSQI Pittsburgh Sleep Quality Index
PHQ-9 Patient Health Questionnaire-9

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Authors' contributions

SS and HA involved in the study's conception and supervision. ME contributed to the initial study design, analyzed the data, and assessed the publishing readiness of the final edition. MAK, MMK, and AN participated in writing the article and modifying it.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This research was carried out in conformity with applicable rules and guidelines in Iran. The study was performed after the ethical approval by the Tehran University of Medical Sciences ethics committee (IR.TUMS.IKHC.REC.1400.078). Informed consent was obtained from all participants, which is available by reasonable requests.

Consent for publication

The authors declare that the article does not contain any personal information about the participants that reveals their identity or makes more data available.

Competing interests

The authors declare that they have no competing interests.

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