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Original Article

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Investigating the Effects of the Subjective Sleep Parameters on COVID-19 Infection Probability and Severity in Medical Interns

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Abstract

Background: Sleep has a well-recognized impact on human immunity. COVID-19 infectivity and severity depend on the immune system of the host. Medical interns are at risk for the development of this disease and have poor sleep quality. In this study, the association between sleep quality and COVID-19 infection development and severity in medical students was evaluated.

Methods: In the current study, 50 medical students were enrolled. Demographic and subjective sleep parameters were documented and compared with COVID-19 infection history and development of dyspnea. Chronotype was assessed by the reduced Morningness-Eveningness Questionnaire (rMEQ).

Results: The total sleep time in infected medical intern were 68.14 minutes shorter than non-infected one (p=0.048). The wake time was one hour and twelve minutes earlier in the group which developed dyspnea (p=0.020). Age, gender, rMEQ score and Body Mass Index (BMI) are significantly associated with neither COVID-19 infection history nor dyspnea.

Conclusion: Short sleep time and early morning awakening are bound up with the prevalence and severity of COVID-19 in medical interns.

Keywords: COVID-19, Human, Immunity Sleep parameter, Sleep time

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Introduction

With the launch of the new COVID-19 pandemic in December 2019, all sections of society in all countries became involved in the fight against this unknown virus. Among the members of the community, the medical staff, especially physicians and nurses were the most affected by this disease since they are the first lines of the fight against this disease (1). Health care workers encompass the significant proportion of COVID-19 infections in the pandemic outbreaks. Exposed health care workers may experience a high incidence of COVID-19 infections, particularly for unprotected and repeated exposures. Furthermore, they may face a greater risk of developing mental health irregularity rather than non-health care workers which might negatively affect their sleep quality (2).

Sleep disorders, and specifically insomnia, have been linked to susceptibility to COVID-19 and health care workers represent two of the five occupational groups with the highest prevalence of short sleep duration (3). COVID-19 outbreak also has caused a huge negative impact on exposed healthcare workers' sleep quality (4). According to Marreli *et al*, the effects of the COVID-19 outbreak include delayed bedtime and wake-up time and increased sleep latency on university students (5). The COVID-19 pandemic has aggravated pre-existing sleep disorder conditions among frontline health care workers (6). It has been shown that medical students have poor sleep qualities (7) but the impact of sleep quality on the infection rate of medical students has not been evaluated precisely. For this purpose, a study was conducted among medical interns to show whether sleep quality increases infection susceptibility or not.

Materials and Methods

It is essential that ethically all the questionnaires be prepared based on the complete satisfaction of the participating patients. The study's protocol was approved by the local ethical research committee (Ethical code: 1399.623), and the written informed consent was obtained from the medical school principal and all participants.

In this cross sectional study, 50 medical students' interns who have been exposed to a new COVID-19 infection during the internship were enrolled during January 2021. Exclusion criteria were hypnotic medicine usage and unwillingness for enrolling in the study. All students were surveyed based on a questionnaire completed by them. The study tools consisted of age, sex, Body Mass Index (BMI), bedtime, subjective sleep latency (time from going to bed and falling sleep), sleep time, and wake time. Chronotype was assessed by the reduced Morningness-Eveningness Questionnaire (rMEQ) (8). The standardized form of questionnaire was used in this study. The questionnaire comprises 5 multiple choice questions about circadian preferences and was translated and validated to Persian (9). All volunteers were at least 4 weeks' COVID-19 symptom free.

COVID-19 diagnosis

The main inclusion criteria for COVID-19 diagnosis were based on the presence of a recent history of common COVID-19 symptoms. These symptoms included fever, cough, dyspnea, sputum, myalgia, arthralgia, headache, diarrhea, rhinorrhea, sore throat, abdominal pain, pharyngeal discomfort, chest pain, decreased smell or taste functions (10). Consequently, samples with symptoms were questioned about Polymerase Chain Reaction (PCR)-positive or COVID-19 imaging findings on Computed Tomography (CT) of the chest. Finally, following by the mentioned criteria, medical interns were divided into three patterns of COVID-19 disease in diagnosis:1) The group that was identified only based on common symptoms such as fever, lethargy, weakness, fatigue, and most importantly, symptoms of upper respiratory infection, 2) The group that was examined according to radiographic, for instance, High-Resolution Computed Tomography (HRCT) findings of the chest had a crazy-paving view, and finally, 3) the group that was identified by molecular tests (polymerase chain reaction). They were also asked about the reoccurrence of the disease.

Statistical analysis

Statistical analyses were performed by using SPSS version 11.5 (IBM, Chicago, IL, USA). The qualitative data between groups were analyzed through performing the Chi-square test, and for quantitative data, we used Mann-Whitney U. p value of less than 0.05 was set for the level of clinical significance.

Table 1. COVID-19 characteristic of participants

COVID-19 + (n=19)	
Diagnosis (cases)	
PCR+ Symptoms	4(21.1%)
Radiology + Symptoms	1(5.2%)
Symptoms only	14(73.7%)
Dyspnea (cases)	
Positive	8 (42.1%)
Negative	11(57.8%)

Results

Two participants were excluded due to hypnotic medicine usage and data of 48 medical students were evaluated. The average age of participants was 25.94 (range 24-37 years) and 50% of all interns were male. Out of all participants, 19 cases became infected with COVID-19, which accounted for 39.6 percent of these students. Details of COVID-19 diagnosis and dyspnea prevalence and reoccurrence are summarized in table 1.

Among demographic and subjective sleep parameters, the sole factor which had a significant association with COVID-19 infections among participants was sleep time (Table 2). The total sleep time in the infected medical intern was 68.14 minutes shorter than non-infected one (p=0.048).

Based on the results, the only factor which had a significant association with dyspnea development in infected participants among demographic and subjective sleep parameters was wake time (Table 3). The wake time was one hour and twelve minutes earlier in the group which developed dyspnea (p=0.020).

Table 2. Association of COVID-19 infection with sleep parameters, sex, age, BMI, and rMEQ

variant	COVID-19 -	COVID-19 +	p-value
Sex (%)			
Male	41.4	63.2	0.140
Female	58.6	36.8	
Age in years			
Mean	25.69	26.32	0.608
SD	0.86	2.73	
rMEQ score			
Mean	13.70	15.06	0.387
SD	3.32	4.55	
BMI in Kg/m^2			
Mean	23.52	22.57	0.101
SD	3.40	3.21	
Bedtime			
Mean time	00:04	00:24	0.220
SD in minutes	70.20’	97.14’	
Sleep latency in minutes			
Mean	23.70’	21.66’	0.934
SD	23.23’	18.92’	
Wake time			
Mean time	06:53	6:55	0.920
SD in minutes	73.50’	74.94’	
Sleep time in minutes			
Mean	01.67’	333.53’	0.048
SD	88.68’	96.56’	
Excessive Morning sleepiness presence percentage	50%	60%	0.487

rMEQ -reduced Morningness-Eveningness Questionnaire.

SD: Standard deviation.

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Table 3. Association of dyspnea in patients with COVID-19 with sleep parameters, sex, age, and BMI.

variant	Dyspnea -	Dyspnea +	p-value
Sex (%) Male Female	 63.6 36.4	 62.5 37.5	 0.960
Age in years Mean SD	 25.55 0.69	 27.38 1.50	 0.272
rMEQ score Mean SD	 13.45 4.82	 17.15 3.55	 0.492
BMI in Kg/m^2 Mean SD	 22.22 3.54	 23.06 3.55	 0.109
Bedtime Mean time SD in minutes	 00:50 72.00’	 23:38 155.80’	 0.152
Sleep latency in minutes Mean SD	 17.25’ 9.38’	 22.37’ 28.25’	 0.897
Wake time Mean time SD in minutes	 7:22 82.80’	 6:10 66.60’	 0.020*
Sleep time in minutes Mean SD	 336.0’ 119.83	 335.0’ 45.82’	 0.635
Excessive Morning sleepiness presence percentage	54.5%	62.5%	0.729

rMEQ: reduced Morningness-Eveningness Questionnaire.

Discussion

These days in many countries around the world, healthcare workers are struggling with stress due to the COVID-19 crisis and facing a greater risk of developing mental health irregularity rather than other professions, and the COVID-19 epidemic might negatively affect their sleep quality (11). Stress, anxiety, and other mental health disorders can decrease the quality of sleep which is highly prevalent among medical intern students, and early detection and management seem imperative (1). Consequently, numerous problems might be created by lack of sufficient sleep in healthcare workers such as COVID-19 infection during the pandemic, and particular attention to the role of cognitive and metacognitive processes is due in order to improve sleep quality (12). Hence, a study to show the correlation between COVID-19 infection and sleep quality seems necessary.

In this study, we evaluated the effects of the new COVID-19 infection on different variables of sleep in 48 medical interns. The results on COVID-19 infection revealed that the most significant difference between the infectious and non-infectious groups was in their sleep time; therefore, there was a significant decrease in total sleep time in infected patients. Our findings on total sleep time hypothesize that sleep disorders might play an important role in COVID-19 infection susceptibility and more importantly, well-recognized risk factors such as older age, high BMI, and male gender. No significant relation between rMEQ and

COVID-19 development and severity was found. It has been shown that variants in circadian rhythm are not linked to health problems as long as they are not associated with restricted sleep time (13). Furthermore, concerning dyspnea in patients with COVID-19, analyses showed that the only parameter that had a significant difference in terms of dyspnea was when patients woke up in the morning. Accordingly, recent studies reported that there is a strong relationship between good sleep quality and normal function of the immune system (14) and our results support this issue. Depression as one of the reasons for early morning awakening is shown to be associated with COVID-19 severity which is compatible with our finding (15). For clarifying such an interesting relationship between COVID-19 infection, early morning awakening and depression, we need depression evaluation in addition to sleep parameters. Melatonin, as a potential agent has been discovered to be clinically promising in sepsis and can alleviate symptoms of other similar viral infections (16). Melatonin is a sleep promoting agent which is secreted by pineal gland. Appropriate secretion of melatonin can cause sleep disturbance and sleep disturbance can afflict immune response to viruses (17). Given the current view, patients with dyspnea in our study, have suffered early wake time which could be due to a disorder of melatonin path which promotes early morning awakening and sleep deprivation and related immune system damage (18). Hence, melatonin may have a greater role in managing COVID-19 infected patients with circadian rhythm disorders.

Conclusion

Short sleep time and early morning awakening are associated with the prevalence and severity of COVID-19 in medical interns in this pilot study. Our results suggest that the lack of enough sleep might be a potential factor to increase the susceptibility to COVID-19 infection in medical students. However, for better judgment, we need prospective and interventional studies as COVID itself can disturb sleep and cause insomnia.

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