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Review

Prevalence of sleep disorders among physicians and nurses during COVID-19 pandemic

Vladislav E. Karnaukhov [1], Ekaterina A. Narodova [1], Irina V. Demko [1], Natalia A. Shnayder [2], Valeriya V. Narodova [1], Diana V. Dmitrenko [1], Regina F. Nasyrova [2]

[1] V.F. Voyno-Yasenetsky Krasnoyarsk State Medical University, Krasnoyarsk, Russia
[2] V.M. Bekhterev National Medical Research Center for Psychiatry and Neurology, Saint Petersburg, Russia

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Abstract: The *objective* of our review was to analyze studies of prevalence sleep disorders among medical workers during COVID-19 pandemic.
Material and Methods — Overall, during the analyzed period, studying domestic and foreign databases, we identified 94 publications on the development of sleep disorders among medical personnel working during COVID–19 pandemic in 2000-2021. However, only 88 of these publications complied with the objective of the review. We included 75 full-text publications in this review.
Results — Physicians and nurses during COVID-19 pandemic do not have the opportunity to take therapy aimed at combating the symptoms of sleep disorders, due to the need to maintain sufficient attention and the risk of developing excessive drowsiness while on duty in a COVID -19 hospital. The latter can have a negative impact on their professional activities. Thus, this problem certainly requires professional psychotherapeutic correction. Unfortunately, not all medical institutions have such specialists.
Conclusion — Based on the literature review, we found out that health care workers have a high risk of developing sleep disorders. This can include violations of the circadian rhythm, a decrease in the quality and duration of night sleep, daytime hypersomnia caused by shift work in a hospital. An additional factor affecting the frequency and severity of sleep disorders in healthcare workers (physicians and nurses) is chronic stress, the importance of which has increased during the COVID-19 pandemic. Currently, the above problem has not been completely solved and requires research in this area and the development of new programs to help medical personnel.

Keywords: pandemic, coronavirus disease, COVID-19, circadian rhythm sleep disorders, insomnia, medical personnel, physicians, nurse.

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Correspondence to Vladislav E. Karnaukhov. Address: Partizan Zheleznyak Street 1, Krasnoyarsk, 660022, Russia. Phone: +79835000484. E-mail: karnauhov.vlad@mail.ru.

Introduction

Currently, the impact of the COVID-19 pandemic on the physical and mental health of medical personnel, working in COVID-hospitals, is being widely discussed [1]. The COVID-19 pandemic is a relatively new type of stress factor or trauma from a psychopathological point of view [2]. Despite the existing clinical guidelines for medical workers, who are under increased emotional stress during the COVID-19 pandemic, the problem of sleep disorders associated with the intensive and shift work of medical personnel and chronic distress is actively studied and is not solved to date [3, 4]. Thus, COVID-19 had become not only a serious infectious attack [5, 6], but also led to an increase in neurological disorders both among the general population [7, 8], and healthcare workers during the COVID-19 pandemic (*Figure* 1).

The mental health of medical staff is necessary for the fight against COVID-19, but sometimes it is difficult to be achieved [10-16]. Researchers have proved that risk factors such as marital status, gender, age, social support play crucial role in the mental health of healthcare workers [17-19]. Also, there are other factors that are important for the development of sleep disorders among healthcare workers, such as psychosocial risks associated with health problems [20], work accidents [21, 22], low job satisfaction, low work engagement [23], burnout syndrome [24, 25] and stress related to intensive work during the COVID-19 pandemic [26]. Based on these studies, coping strategies were suggested. For instance, social support can improve the mental health of medical staff, who treat patients with COVID-19, and reduce the risk of sleep disorders, associated economic losses, unintentional medical errors and reduced working efficiency [27-29].

To analyze studies on the prevalence and nature of sleep disorders among healthcare workers during the COVID-19 pandemic.

Material and Methods

This review includes available full-text publications obtained as a result of a literary search in domestic (E-Library) and foreign databases (PubMed, Scopus, Oxford University Press, Springer, Web of Science Core Collection). The search was limited to studies published in 2019-2021.

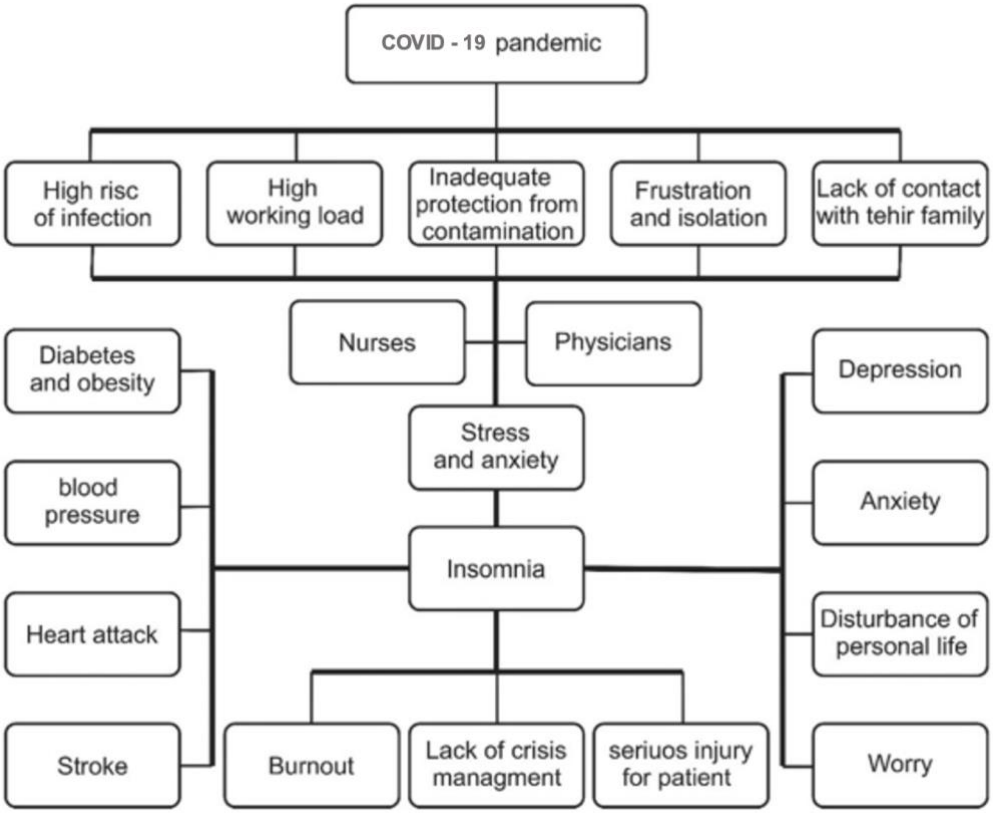

Figure 1. The impact of the COVID-19 pandemic on sleep disorders among medical personnel [9].

We used the following keywords to select the publications: pandemic, coronavirus, COVID-19, circadian rhythm sleep disorders, insomnia, medical personnel, doctors, nurses.

In general, we studied domestic and foreign databases and identified 94 publications about the development of sleep disorders among healthcare workers during COVID-19 pandemic in 2000-2021. However, only 88 of these publications reflected the aim of the review. We included 75 full-text publications in this review.

Results

Medical personnel, including doctors, and nurses [30], as well as medical students and caregivers of COVID-19 patients [31], are potentially at risk of developing sleep disorders that can negatively affect their daily life and efficiency, including an increased risk of unintentional medical errors [32, 33]. This is primarily due to the fact that medical personnel, working in COVID-hospitals, experience psychological conflicts, being torn between the responsibilities of caring and treating infected patients and ensuring their own safety. As a result of the growing number of COVID-19 infection cases among their colleagues, the development and impact of psychological distress on these people has become significant [34-37].

Sleep disorders due to psychological distress, disorders of the circadian rhythm due to the shift and stressful work, as well as the development of anxiety and depressive disorders, are the most common neurological symptoms for healthcare workers, who are in direct contact with COVID patients (*Table* 1) [38, 39], and territorial hospitals [40-44].

Sleep disorders among medical workers during the COVID-19 pandemic

According to the Southern Medical University (Guangzhou, China) [45], the prevalence of insomnia among medical personnel during COVID-19 pandemic was 36.1%.

In another Chinese study, conducted by Lin L. Y., Wang J. et. al. [46], using an online questionnaire with the Insomnia Severity Index, a sample of 5,461 medical workers from February 5, 2020 to February 23, 2020 revealed that the prevalence of clinical insomnia during the COVID-19 outbreak was 20.05% (1,131 people).

In a study by Wang W., Song W. et.al [47], the authors analyzed 2,737 questionnaires of healthcare workers from March 4 to March 9, 2020. The Pittsburgh Sleep Quality Index was used as a questionnaire for the sleep study. It was found that during the analyzed period, 61.6% of respondents had sleep disorders. Medical staff, working in COVID-hospitals, were more prone to serious sleep disorders compared to those, who did not work in COVID conditions.

Jahrami H., BaHammam A.S. et.al. [44], analyzed the questionnaires of 280 healthcare workers from several institutions, belonging to the Ministry of Health of Bahrain. They used an online questionnaire based on the Pittsburgh Sleep Quality Index. 75.2% of respondents had sleep disorders.

Table 1. Prevalence of sleep disorders in medical personnel during the COVID-19 pandemic

Nation	*Number of participants*	*Study description*	*The incidence of sleep disorders (%)*	*References*
China	5,461 medical workers; 1,505 (29.9%) men and 3,956 (70.1%) women.	Insomnia Severity Index	20.05%	[46]
	1,257 medical workers, 493 (39.2%) physicians; 764 (60.8%) nurses.	Insomnia Severity Index	34.0%	[13]
	1,563 medical workers	Insomnia Severity Index	36.1%	[45]
	100 nurses	Pittsburgh Sleep Quality Index	60%	[55]
	1,931 nurses	Pittsburgh Sleep Quality Index	18.4%	[56]
	274 doctors	The Pittsburgh Sleep Quality Index	38%	[50]
	2,001 medical workers	Pittsburgh Sleep Quality Index	61.6%	[47]
	33,062 medical workers	Athens Insomnia Scale Insomnia Severity Index Pittsburgh Sleep Quality Index	38.8%	[92]
India	100 doctors	Experimental scale	30%	[51]
Iraq	268 doctors	Athens Insomnia Scale	68.3%	[52]
Meta analysis (China, Iraq)	5,868 medical workers, of which: 2,123 doctors; 3,745 nurses	Athens Insomnia Scale Insomnia Severity Index Pittsburgh Sleep Quality Index	41.6%	[9]
Russian	812 medical workers	Subjective assessment of sleep quality	37.4 %	[48]
	500 medical workers	Subjective assessment of sleep quality	18.1%	[49]
Oman	1,139 doctors	Insomnia Severity Index	18.5%	[13]
Turkey	939 medical workers	Insomnia Severity Index	50.4%	[93]
Bangladesh	370 doctors	Sleep Condition Indicator	18.6%	[54]
Spain	100 medical workers	Epworth Sleepiness Scale Pittsburgh Sleep Quality Index Insomnia Severity Index	47.65 %	[94]
Bahrain	257 medical workers	Pittsburgh Sleep Quality Index	75.2%	[44]

Table 2. Prevalence of sleep disorders among students during the COVID-19 pandemic

Nation	*Number of participants*	*Study description*	*The incidence of sleep disorders*	*References*
Saudi Arabia	453	Insomnia Severity Index	34.9%	[57]
	438	Sleep-50	73.7%	[58]
China	1,026	Modified Chinese version of Pittsburgh Sleep Quality Index Scale	33.2%	[59]
	606	Insomnia Severity Index	32.0%	[60]
	3,092	Self-Rating Scale of Sleep	13.5%	[61]
	29,663	Insomnia Severity Index	44.13%	[62]
Nepal	168	Pittsburgh Sleep Quality Index Scale	30.36%	[63]
Indonesia	101	Insomnia Severity Index	44.6%	[64]
Morocco	549	Insomnia Severity Index	62.6%	[65]
Russian	110	Psycho-COVID-19 Questionnaire of psychoemotional state and sleep disorders	26.4%	[66]
	159	Insomnia Severity Index	43.4%	[67]

A cross-sectional study was conducted with the participation of 812 medical workers from 77 regions of Russia, including doctors and nurses, working during the COVID-19 pandemic [48]. In addition to assessing anxiety and depression, this study evaluated the quality of respondents' sleep on a subjective scale from 0 to 10 (where 0 is a severe sleep disorder, 10 is the quality of sleep is not disturbed). The results of the survey showed that 37.4% of medical workers (305 people) had a sleep disorder (maximum severity: up to 5 points).

The Union for the Protection of Mental Health and the Scientific and Educational Center for Modern Medical Technologies conducted comprehensive domestic survey on the psychological state of healthcare workers during the COVID-19 pandemic [49]. More than 500 people participated in this survey. The participants were doctors, nurses, university staff, junior medical staff from 66 regions of Russia. According to the subjective assessment of sleep quality, 18.1% rated sleep quality disorders from 0 to 3 points, while only 3.7% of the surveyed medical workers experienced a severe sleep disorder.

Sleep disorders among doctors during the COVID-19 pandemic

In a study, conducted in Hubei Province (China) from February 26 to March 3, 2020, among doctors (a total of 274 people) working during the COVID-19 pandemic [50], data from a survey, using the Pittsburgh Sleep Quality Index, were presented. The questionnaire contained 19 questions for subjective self-assessment of sleep quality. Sleep disorders were detected in 38% of participants, who scored more than 5 points on the Pittsburgh Sleep Quality Scale.

The Indian study, conducted among practicing orthopedic surgeons (100 people) [51], using an experimental sleep quality scale (from 0 to 10 points, where 10 is the best result), a decrease in sleep quality was detected in 30% of cases.

Iraqi researchers [52] tested patients according to the Athens Insomnia Scale. The scale was a psychometric sleep self-

assessment tool, based on the criteria established by the International Classification of Diseases (ICD-10). The scale contained 8 points for assessing falling asleep, night and early morning awakening, sleep time, sleep quality. A total of 268 doctors participated in the study, including surgeons, general practitioners, and internists. Sleep disorders were detected in 68.3% of doctors participating in this study during the COVID-19 outbreak.

In Oman, a study was conducted on the sleep quality in 1,139 doctors working during the COVID-19 from April 8 to April 17, 2020 [53]. They conducted the study using an online questionnaire of the Insomnia Severity Index. A total of 1,167 questionnaires of respondents were received, 28 of which were not completed. Thus, only 1,139 questionnaires were used for further analysis. As a result, it was revealed that 18.5% of doctors during the COVID-19 pandemic noted a violation of the sleep quality.

Another study was conducted in Bangladesh: 370 subjects (doctors working during the COVID-19 pandemic) [54], answered to an online questionnaire of a two-position version of the sleep status indicator, and sleep disorders were detected in 18.6% of respondents.

Sleep disorders among nurses during the COVID-19 pandemic

In order to analyze the sleep quality in nurses working during the COVID-19 pandemic, a study was conducted in Wuhan (China) [55] using the Pittsburgh Sleep Quality Index. In general, among the 100 participants, 60% (60 nurses), according to the questionnaire, had low sleep quality.

Another study conducted in Liaoning Province (China) from February 21 to 23, 2020 [56], using the Pittsburgh Sleep Quality Index, showed that among 1,931 nurses, 18.4% suffered from sleep disorders.

Sleep disorders among medical students in during the COVID-19 pandemic

We analyzed a study conducted among medical students of the King Saud University's College of Medicine, Riyadh, Saudi Arabia during the COVID-19 epidemic [57]. The total number of participants was 453 people from the 3rd to the 5th year of training. The study used the Insomnia Severity Index Scale. According to the results, 162 (34.9%) participants had symptoms of insomnia.

In another study conducted in Umm Al-Qura (Saudi Arabia) during the COVID-19 epidemic [58], among 438 medical students in the 2-6 year of study, 73.7% of respondents had sleep disorders.

In three similar studies conducted in China among medical students during the COVID-19 pandemic [59-62] symptoms of sleep disorders were found in 13.5-44.13%, according to various authors.

A study was conducted among medical students from the 1st to 4th year of study in Kathmandu (Nepal) from January 13, 2021 to February 15, 2021 [63]. The researchers used the Pittsburgh Sleep Quality Index in the Google form. Google forms were sent out by email to 190 respondents, but only 168 respondents returned the completed forms. The survey revealed that 30.36% (n=51) of respondents had low sleep quality.

In studies conducted in Indonesia and Morocco [64, 65] among medical students during COVID-19, sleep disorders were detected in 44.6% and 62.6% of cases, respectively.

According to the studies of medical students conducted in the Russian Federation [66-67] using various sleep quality questionnaires, sleep disorders were detected in 35%, 26.4% and 43.4% according to various authors.

Discussion

We analyzed 18 studies, including foreign and Russian publications (*Table* 1). The frequency of sleep disorders among healthcare workers during the COVID-19 varied from 20.05% [46] to 75.2% [44]. The mean frequency of occurrence was 44.28±15.45 %.

Of the 18 articles we analyzed, 5 studies were about sleep disorders among doctors (*Table* 1). The frequency of occurrence of sleep disorders varied from 18.5% to 68.3%. The mean frequency of occurrence was 35.57±16.96%.

Of the 18 articles we analyzed, 2 were devoted to the study of sleep disorders among nurses (*Table* 1). The frequency of occurrence of sleep disorders varied from 18.4% to 41.6%. The mean frequency of occurrence was 38.65±17.23%.

We have found and analyzed 12 studies, including foreign and Russian publications (*Table* 2). The frequency of occurrence of sleep disorders among students working in COVID-19 varied from 13.5% to 73.7% [61]. The mean frequency of occurrence was 39.48±15.4%.

Sleep disorders during the COVID-19 pandemic are closely associated with high levels of related anxiety, alcohol or drug use and suicidal thoughts [68]. Sleep disorders can also cause adverse consequences for the mental, social and cognitive functioning of healthcare workers, which leads to a deterioration in the overall life quality and a decrease in working efficiency [69, 70].

A study, conducted by Huang Y.E. and Zhao N. [41], reported an increase in the prevalence of sleep disorders among healthcare workers during the COVID-19, which was significantly higher than the prevalence of sleep disorders among other groups of people.

It is known that sleep disorders are one of the crucial problems in the field of public health. This disorder negatively affects the life quality of millions of people around the world [71, 72]. Lack of sleep has a significant negative impact on personal life and leads to a decrease in physical activity [73, 74]. Sleep disorders are associated with various physical complications, including an increased risk of obesity, diabetes, high blood pressure, increased heart rate, heart attack and stroke [75]. On the other hand, high-quality sleep can quickly improve the body functioning, relieve fatigue associated with work, maintain energy levels and mental health [76, 77]. Due to the nature of the working conditions of nurses and doctors during COVID-19 (consecutive work shifts), sleep disorders are highly common among medical personnel and cause a number of psychological disorders in the daily activities of these groups of people [78, 79].

The decrease in workforce productivity among healthcare workers associated with insomnia often has serious irreversible consequences. For instance, due to fatigue, errors that lead to the death of the patient may occur [80, 81]. Moreover, sleep disorders increase the symptoms of burnout, which greatly affects the efficiency of medical workers in critical situations [16].

Compared to previous epidemics, the COVID-19 pandemic may be more complex due to some of its features. These are high contagiousness, rather low level of knowledge about the course of infection and its long-term consequences, as well as the lack of established methods of effective treatment or vaccination [82-84]. In addition, for most hospitals around the world, this is an unprecedented scenario, which is accompanied by great problems in relation to various aspects of healthcare-hygiene concepts, measures and equipment necessary for protection, and the expansion of intensive care units, etc [85, 86]. In addition to short-term psychological stress, it has been shown that factors such as quarantine, work in high-risk wards and contact with infected patients are associated with long-term post-traumatic symptoms during the COVID-19 pandemic [87]. Recent studies report that health workers, fearing being infected, felt stigmatized [88] and had sleep disorders [13, 89-94].

Medical personnel during the COVID-19 pandemic do not have the opportunity to take therapy aimed at combating the symptoms of sleep disorders, due to the need to maintain sufficient attention and the risk of developing excessive drowsiness while on duty in a COVID hospital. The latter can have a negative impact on their professional activities. Hence, this problem certainly requires professional psychotherapeutic correction. Unfortunately, not all medical institutions have such specialists.

Conclusion

Based on the literature review, we discovered out that healthcare professionals had a high risk of developing sleep disorders. These included disorders of their circadian rhythm, a decrease in the quality and duration of night sleep, daytime hypersomnia caused by shift. An additional factor affecting the frequency and severity of sleep disorders in healthcare workers (physicians and nurses) was chronic stress, the importance of which has increased during the COVID-19 pandemic. Currently, the above problem has not been completely solved and requires further research and the development of new programs to help medical personnel.

Conflict of interest

None declared.

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Authors:
Vladislav E. Karnaukhov – MD, PhD Student, Department of Medical Genetics and Clinical Neurophysiology, V.F. Voyno-Yasenetsky Krasnoyarsk State Medical University, Krasnoyarsk, Russia. http://orcid.org/0000-0002-4002-8548.
Ekaterina A. Narodova – MD, DSc, Associate Professor, Department of Nervous Diseases with a Course of Medical Rehabilitation of Postgraduate Education, V.F. Voyno-Yasenetsky Krasnoyarsk State Medical University, Krasnoyarsk, Russia. http://orcid.org/0000-0002-6184-9206.
Irina V. Demko – MD, DSc, Professor, Department of Hospital Therapy and Immunology, V.F. Voyno-Yasenetsky Krasnoyarsk State Medical University, Krasnoyarsk, Russia. http://orcid.org/0000-0001-8982-5292.
Natalia A. Shnayder – MD, DSc, Professor, Leading Researcher, Department of Personalized Psychiatry and Neurology, V.M. Bekhterev National Medical Research Center for Psychiatry and Neurology, Saint-Petersburg, Russia. http://orcid.org/0000-0002-2840-837X.
Valeriya V. Narodova – MD, DSc, Professor, Department of Nervous Diseases with a Course of Medical Rehabilitation of Postgraduate Education, V.F. Voyno-Yasenetsky Krasnoyarsk State Medical University, Krasnoyarsk, Russia. http://orcid.org/0000-0003-4081-5805
Diana V. Dmitrenko – MD, DSc, Professor, Head of the Department of Medical Genetics and Clinical Neurophysiology, Institute of Postgraduate Education, V.F. Voyno-Yasenetsky Krasnoyarsk State Medical University, Krasnoyarsk, Russia. http://orcid.org/0000-0003-4639-6365.
Regina F. Nasyrova – MD, DSc, Chief Researcher, Department of Personalized Psychiatry and Neurology, V.M. Bekhterev National Medical Research Center for Psychiatry and Neurology, Saint-Petersburg, Russia. http://orcid.org/0000-0003-1874-9434.