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Insomnia and stress of physicians during COVID-19 outbreak

Deldar Morad Abdulah [a, *], Dildar Haji Musa [b]

[a] Community Health Unit: College of Nursing, University of Duhok, Iraq
[b] Department of Surgery, College of Medicine, University of Duhok, Iraq

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ABSTRACT

Background: Healthcare workers are at high risk of developing sleep disorders during an outbreak. This study aimed to measure severity of sleep difficulty and its correlation with duration of deal with suspected/confirmed cases of novel coronavirus (COVID-19) in physicians.
Methods: In this cross-sectional study, 268 physicians from different medical settings were included during the COVID-19 outbreak.
Results: The mean age and experience of physicians were 35.06 (33–70 years) and 10.13 years. The median duration of dealing with suspected/confirmed cases of COVID-19 was 1.0 (0–30 days). The mean sleep score and stress of physicians were 8.43 of 24.0 and 4.20 of 10, respectively. More than two-thirds of the physicians were sleepless (68.3%) and majority had stress (93.7%). The study did not find a significant difference in sleep score of physicians with different specialties ($P = 0.059$). However, most physicians were sleepless; including anesthesia and intensive care (77.8%); general physicians (80.8%), and obstetrics and gynecology (80.0%). They were sleepless in morning (58.7%); evening (77.8%); night (100%); and multi-shift (70.9%). The physicians who dealt with suspected or confirmed cases of COVID-19 or with stress had more escalated sleep compared to those who did not deal with patients or without stress (9.39 vs. 7.17 and 8.78 vs. 2.69 $P < 0.001$). The sleep of physicians was escalated with increasing stress ($r = 0.558$; $P < 0.001$) and a number of days that physicians dealt with suspected/confirmed cases of COVID-19 ($r = 0.210$; $P = 0.001$), respectively.
Conclusion: The study confirmed that working with COVID-19 patients has a negative effect on the sleep of physicians.

1. Introduction

A novel coronavirus outbreak of pneumonia was emerged from China, in December 2019 [1]. This outbreak was then spread globally [1]. Healthcare workers (HCWs) of Wuhan faced a great amount of pressure during their fight against the novel coronavirus (COVID-19) outbreak. Healthcare workers faced the pressure of a high risk of infection, inadequate protection from contamination, high working load, frustration, discrimination, isolation, patients with negative emotions, a lack of contact with their families, and exhaustion [2]. The severe status during any infection outbreak may develop many mental health issues, including stress, anxiety, depressive symptoms, anger, insomnia, fear, and sleep disorders. These mental health issues do not impact healthcare workers' attention, understanding, and decision making, yet there is an impact on physicians' overall health status. It is necessary to protect physicians from mental health problems to control the epidemic and their long-term wellbeing [3]. Moreover, it is helpful to find out the mental health response after a public health emergency in medical workers [1].

There is a consensus that the COVID-19 pandemic has not only an effect on physical health, but also on mental health and mental wellbeing [4,5]. The previous studies have reported that HCWs who work in the frontline during viral epidemic outbreaks are at high risk for developing mental health issues [6]. This pandemic is a relatively new kind of stressor or trauma from a psychopathological perspective [3].

The psychological inherence of stress in physicians during the COVID-19 outbreak has serious influences on overall wellbeing. Therefore, it is essential to explore the level of sleep difficulty and stress level of HCWs during the current outbreak.

* Corresponding author.
E-mail addresses: deldarmorad@gmail.com (D.M. Abdulah), dildar@uod.ac (D.H. Musa).

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The physicians who provide frontline healthcare during outbreaks are more likely to develop mental work-related problems, including short and long term types [7]. By 30 March 2020, the outbreak was spread globally. There were several confirmed reported cases (n = 963,000) and deaths (n = 33,000) [8]. The early anecdotal evidence in Wuhan has confirmed that this situation during the outbreak affects the mental status of physicians who provide healthcare services in the frontline, including changes in anxiety, depressive symptoms, anger, fear, and sleep [3]. Huang and Zhao [9] reported that HCWs who worked during the COVID-19 outbreak were more likely to have poor sleep quality compared to other occupational groups. This study aimed to measure the severity of sleep difficulty and its relation to the duration of dealing with suspected/confirmed cases of COVID-19 and stress level of physicians in Iraqi Kurdistan.

2. Subjects and methods

2.1. Study design and sampling

In this cross-sectional study, the physicians who dealt or did not deal with suspected or confirmed cases of COVID-19 were invited irrespective of the medical or sociodemographic perspectives. We obtained a list of physicians who work in medical settings from the local general directorate of health. The general public medical settings were included in this study were one pediatric, one emergency, one special corona, and one maternity and gynecology hospital. The physicians were invited from different clinical departments, including medical, surgical, outpatient, operation room, anesthesia, etc.

An online Google Form was created based on a pre-designed questionnaire and was sent to the personal accounts of the physicians either through social media, email, or other online systems. The physicians were invited from different specialties as mentioned in the following. We used a web-based Google Form to prevent the spread of diseases through droplets or contacts. To accelerate the process of the response, we uploaded the link of the questionnaire into the social media page of the physicians in this region, since the majority of physicians are members of the page.

The subjects were invited from both genders and regardless of medical and sociodemographic aspects. We sent on online Google Form to the physicians including an invitation message explained the aim of the study with a consent form. We sent the second notification to all physicians to remind them to fill the submitted online questionnaire. The data collection was performed between 19th and 24th April 2020. Of the total 400 physicians who were invited into the study, 268 of them filled the questionnaire (Response rate: 268/400*100 = 67%).

2.2. Data collection and measurements

The entire information of the physicians was collected through an online technique. The following information was collected; age, gender, and experience in medicine since graduation from the medical college, medical specialty, and the number of days that physicians dealt with suspected or confirmed cases of COVID-19 since the last month.

The specialties were categorized as anesthesia and intensive care, lab specialties, internal medicine specialties, community and family medicine, surgery, general physicians (GP), obstetrics and gynecology, pediatrics, psychiatry, and radiology. The lab specialties were medical microbiology, biochemical, and hematology. The following specialties were categorized in internal medicine; cardiology, respiratory, general internal medicine, rheumatology, neurology, nephrology, and oncology. The following specialties were categorized in the surgery specialties; general surgery, urology, emergency, ENT, ophthalmology, and orthopedics.

The severity of sleep difficulty was measured by the Athens Insomnia Scale (AIS). This scale is a self-assessment psychometric instrument designed to quantify sleep difficulty based on the criteria set by the International Classification of Diseases (ICD-10). The scale has 8 items to evaluate sleep onset, night and early-morning waking, sleeping time, quality of sleep, complaints frequency and duration, distress due to insomnia, and its interference with daily functioning [10]. It has been validated in patients with insomnia and with controls aged 18–79 years. It takes 3–5 min to deliver and it is a self-reported measure. The internal consistency of the scale was 0.818 (Cronbach's alpha) for this study. The validity of the instrument has been highly shown to correlate with scores obtained from Sleep Problems Scale (0.85–0.90). In this scale, the sleep difficulty severity is measured based on a 4-point Likert scale since last month. The scores ranged from 0 (meaning not being a problem) to 3 (meaning more acute sleep difficulties). A cut-off score of 6 has been determined to distinguish between insomnia and healthy subjects [11].

Lastly, we asked the physicians to assess the perceived stress made on them during the COVID-19 outbreak and rate from 0 (no stress) to 10 (highest intense perceived stress) based on the ladder technique.

2.3. Statistical analyses

The descriptive characteristics of the physicians were presented in mean and Std. Deviation or number and percentage. The severity of insomnia and sleep items were determined in mean and Std. Deviation. The prevalence of insomnia in physicians was determined in number and percentage. The comparison of sleep score levels among physicians with different characteristics was examined in an independent t-test or ANOVA-one way. The correlation of sleep with stress, deal duration with suspected/confirmed cases of COVID-19, age, and the experience was examined in Spearman's rho test and was presented in a matrix scatter plot. The significant difference was determined in a P-value of less than 0.05. The statistical calculations were performed by statistical package for social sciences version 25 (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp).

2.4. Ethical considerations

The written consent form was taken from all physicians before filling the pre-designed questionnaire. The protocol of this study was approved by the College of Nursing, University of Duhok. The confidentiality of the personal information of the physicians was protected throughout the study steps. The participation was completely voluntary and non-commercial according to the Declaration of Helsinki.

2.5. Results

The mean age of the physicians was 35.06 (SD: 7.61) ranged between 33 and 70 years. The mean experience of the physicians in medicine was 10.13 (SD: 7.33) years. The median of the duration of dealing with suspected/confirmed cases of the COVID-19 was 1.0 between 0 and 30 days. The physicians were males (70.1%) and females (29.9%) and worked in the morning (28.0%), evening (3.4%), night (1.9%), and multi-shift (66.8%). The physicians were surgeons (32.1%), general physicians (27.2%), internists (13.8%), medical lab specialties (6.0%), and some other specialties (Table 1).

The mean sleep score of the physicians was 8.43 of 24.0. The mean score of the stress was 4.20 of 10. More than two-thirds of the

Table 1
General characteristics of physicians.

Characteristics (n = 268)	Statistics	
	Mean	Std. Deviation
Age (Range: 33–70 years)	35.06	7.61
30–40 years	204	76.1
41–50 years	48	17.9
51–60 years	15	5.6
61–70 years	1	0.4
Experience (Range: 0–47 years)	10.13	7.33
Duration of deal with Cocid-19 Patients (Range:0–30)	Median: 1.0	Interquartile Range: 4.0
	Number	**Percentage**
Gender		
Male	188	70.1
Female	80	29.9
Working Shift		
Morning (8 am - 2 pm)	75	28.0
Evening (2pm–8pm)	9	3.4
Night Shift (8 pm - 8 am)	5	1.9
Multi shift	179	66.8
Specialty		
Anesthesia and intensive care	9	3.4
Medical lab specialties	16	6.0
Internal medicine specialties	37	13.8
Community and family medicine	1	0.4
Surgery specialties	86	32.1
General physicians	73	27.2
Obstetrics and Gynecology	15	5.6
Pediatrics	6	2.2
Radiology	25	9.3

physicians were sleepless during the COVID-19 outbreak (68.3%) and majority had stress (93.7%). The physicians reported that they slept slightly delayed (Mean [M]: 1.18) and had a minor problem with awakenings during the night (M: 1.08). They woke slightly earlier than desired (M: 1.02) and had slightly insufficient sleep duration (M: 1.08) and slightly unsatisfactory quality of sleep (M: 1.09). The sense of well-being during the day was slightly decreased (M: 1.09). The physicians reported slightly decreased physical and mental functioning during the day (M: 0.82) and had mild sleepiness during the day (M: 0.85), see Table 2.

The study did not find a significant difference in the sleep score of physicians with different specialties (P = 0.059) and age groups (P = 0.150). However, the study revealed that most of the physicians in all specialties (except for community and family medicine) were sleepless; including anesthesia and intensive care (77.8%); medical lab specialties (56.3%), internal medicine specialties (64.9%), surgery specialties (62.8%); general physicians (80.8%), obstetrics and gynecology (80.0%), pediatrics (66.7%), and radiology (56.0%), see Table 3.

The study revealed that female physicians had a significantly worse status of sleep compared to male physicians (9.14 vs. 8.13: P = 0.034). The prevalence of insomnia was significantly higher in females (77.5% vs. 64.4%), respectively. The study did not find a significant difference in the score level of sleep of physicians who worked in different shifts (P = 0.147). But, most of the physicians in all shifts were sleepless included; morning (58.7%); evening (77.8%); night (100%); and multi-shift (70.9%). A similar pattern was found in physicians who were shift-rotator and non-shift rotator

Table 2
Mean score and prevalence of insomnia in physicians.

Characteristics (n = 268)	Statistics	
	Mean	Std. Deviation
Sleep score (Range: 0–22)	8.43	4.82
Stress score (0–10)	4.20	2.46
Sleep induction (the time it takes you to fall asleep after turning off the lights)	1.18	1.00
Awakenings during the night	1.08	0.96
Final awakening earlier than desired	1.02	0.94
Total sleep duration	1.08	0.92
The overall quality of sleep (no matter how long you slept)	1.09	0.87
Sense of well-being during the day	1.09	0.92
Functioning (physical and mental) during the day	0.82	0.70
Sleepiness during the day	0.85	0.69
	Number	**Percentage**
Insomnia		
Healthy	85	31.7
Sleepless	183	68.3
Stress categories		
No stress	17	6.3
With different levels of stress	251	93.7

Table 3
Comparison of sleep score level among physicians with different characteristics.

Characteristics (n = 268)	Sleep Score	Insomnia Categories		P-Value
	Mean	Healthy	Sleepless	
Age categories				0.150[a]
30-40	8.80 (4.89)	57 (27.9)	147 (72.1)	
41-50	7.35 (4.73)	21 (43.8)	27 (56.3)	
51-60	6.93 (3.63)	7 (46.7)	8 (53.3)	
61-70	6.00	0 (0.0)	1 (100)	
Specialty				0.059[a]
Anesthesia and intensive care	10.67 (5.79)	2 (22.2)	7 (77.8)	
Medical lab specialties	7.06 (6.01)	7 (43.8)	9 (56.3)	
Internal medicine specialties	7.68 (4.72)	13 (35.1)	24 (64.9)	
Community and family medicine	0.00	1 (100.0)	0 (0.0)	
Surgery specialties	7.78 (4.67)	32 (37.2)	54 (62.8)	
General physicians	9.78 (4.42)	14 (19.2)	59 (80.8)	
Obstetrics and Gynecology	7.73 (3.37)	3 (20.0)	12 (80.0)	
Pediatrics	9.00 (5.73)	2 (33.3)	4 (66.7)	
Radiology	8.52 (5.28)	11 (44.0)	14 (56.0)	
Gender				0.034[b]
Male	8.13 (4.87)	67 (35.6)	121 (64.4)	
Female	9.14 (4.67)	18 (22.5)	62 (77.5)	
Working shift				0.147[a]
Morning (8 am - 2 pm)	7.65 (4.79)	31 (41.3)	44 (58.7)	
Evening (2 pm–8 pm)	7.13 (1.96)	2 (22.2)	7 (77.8)	
Night Shift (8 pm - 8 am)	10.75 (1.71)	0 (0.0)	5 (100)	
Multi-shift	8.63 (4.81)	52 (29.1)	127 (70.9)	
Working Shift				0.211[b]
Non-shift rotators	7.86 (4.65)	33 (37.1)	56 (62.9)	
Shit-rotators	8.63 (4.801)	52 (29.1)	127 (70.9)	
Dealing with patients				<0.001[b]
Not dealing with patients (n = 122)	7.17 (4.47)	52 (42.3)	71 (57.7)	
Dealt with patients (n = 145)	9.39 (4.77)	33 (22.8)	112 (77.2)	
Stress Categories				<0.001[b]
No Stress	2.69 (2.33)	14 (82.4)	3 (17.6)	
Stress with different levels	8.78 (4.72)	71 (28.3)	180 (71.7)	

[a] ANOVA-One way.
[b] Independent t-test were performed for statistical analyses.

(P = 0.211). Both shift-rotators and non-shift rotators had a high prevalence of insomnia (70.9% vs. 62.9%). The sleep of the physicians who dealt with suspected or confirmed cases of COVID-19 was significantly escalated compared to those who did not deal with patients (9.39 vs. 7.17; P < 0.001) and was more likely to be sleepless (77.2% vs. 57.7%), respectively (Table 3; Fig. 1a).

We found that the physicians with stress had worse status of sleep compared to the physicians without stress; 8.78 vs. 2.69; P < 0.001 (Table 3; Fig. 1b).

The study showed that sleep of the physicians was escalated with increasing stress (r = 0.558; P < 0.001) and the number of days that physicians dealt with suspected or confirmed cases of COVID-19 (r = 0.210; P = 0.001). While, the sleep score was decreased with increasing age (r = −0.190; P = 0.002) and experience (r = −0.206 and P = 0.001), see Table 4 and Fig. 2.

3. Discussion

The present study showed that most of the physicians with different specialties were sleepless with a significant positive correlation with the number of days dealt with the suspected/confirmed cases of the COVID-19. The patients who dealt with the cases of COVID-19 patients had significantly worse sleep difficulty.

A previous study conducted in the same region in 2019 has reported that 45.5% of the physicians were sleepless, however, 68.3% of the physicians were sleepless in this study during COVID-19 outbreak [12]. Meeting sufficient sleep during the COVID-19 is important since the good night's sleep is considered to be one of the best ways to improve the immunity and defend against viruses and diseases [13]. In addition, insomnia has been reported to have an indirect association with negative categories of the doctor–patient relationship [12]. Sleep and the circadian system pose a strong regulatory influence on immune functions. The normal sleep–wake cycle has been shown to affect the number of undifferentiated naïve T cells and the production of pro-inflammatory cytokines. Furthermore, sleep has been suggested to facilitate the extravasation of T cells and their possible redistribution to lymph nodes [13].

Currently, few investigations have examined the effects of sleep on the response to vaccinations as an experimental model of infection. The literature reported that sleep improves the adaptive immune response against the antigen. The individuals who regularly slept on the first night after vaccination had a twofold increase in antigen-specific antibody titers after four weeks [14].

We found that the physicians who had longer duration with suspected/confirmed cases of COVID-19 had worse sleep difficulty with no exemption in medical specialties. Huang and Zhao [9] explored the mental health burden of the public during the COVID-19 outbreak in a web-based cross-sectional study. They reported that the overall prevalence of general anxiety disorder (GAD), depressive symptoms, and sleep quality were 35.1%, 20.1%, and 18.2%, respectively. Notably, HCWs had significantly poor sleep quality compared to other occupational groups. The regression analysis showed that age <35 years and time spent on the COVID-19 (≥3 h per day) were associated with GAD. The study showed that HCWs are at high risk for poor sleep quality (OR = 1.48, 95% CI: 1.15–1.95).

The present study showed that the sleep was more escalated by stress rather than days spent focusing on the COVID-19; r = 0.558 and r = 0.210, respectively. The reason behind this finding is that the HCWs work periodically in corona special hospital. Therefore,

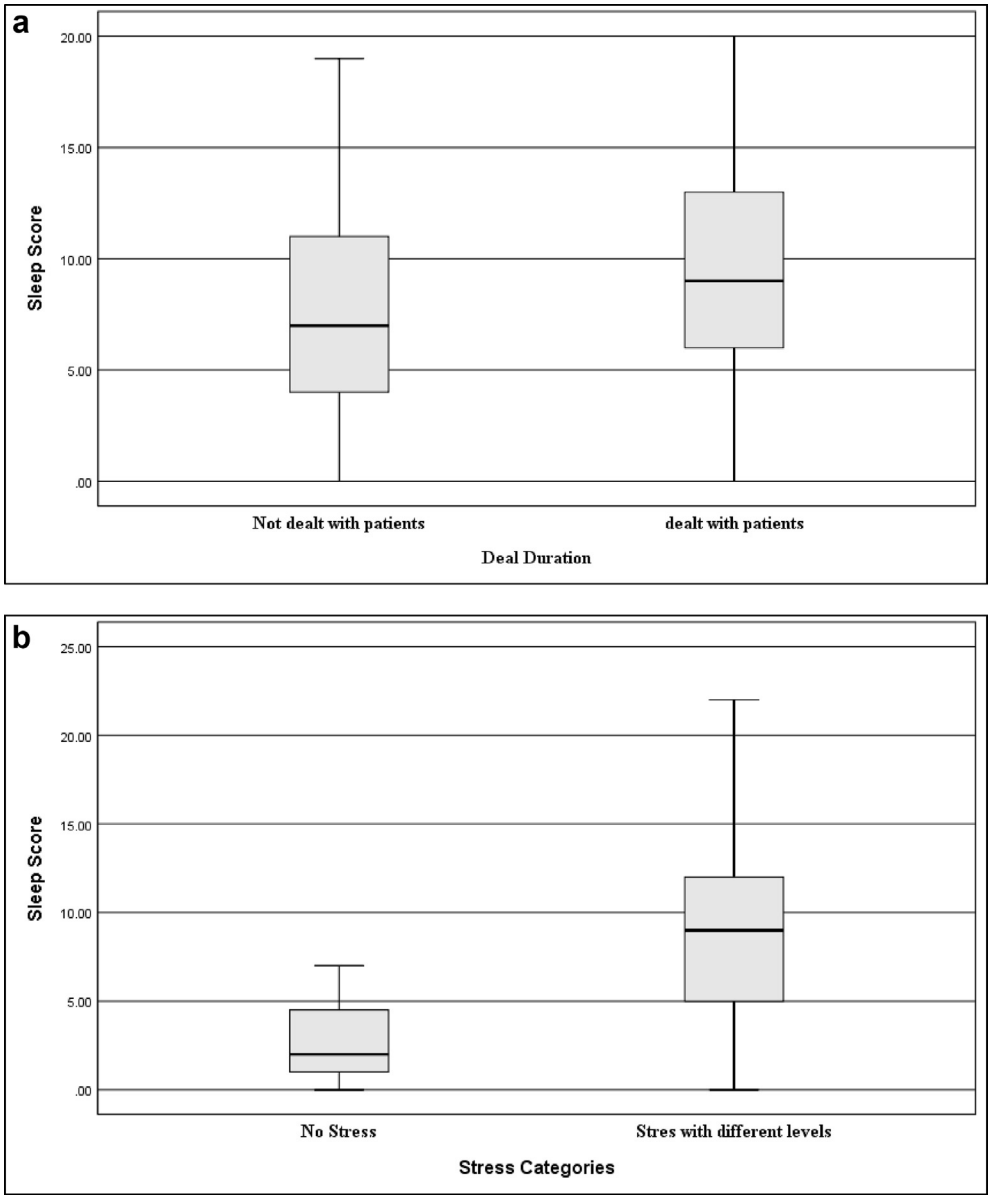

Fig. 1. Comparison of sleep severity in physicians with different stress and duration with the suspected/confirmed cases of COVID-19. Fig. 1a: Comparison of sleep between physicians who dealt and did not deal with suspected/confirmed cases of COVID-19. Fig. 1b: Comparison of sleep between physicians with and without stress.

Table 4
The correlation of sleep with stress and deal duration with suspected/confirmed cases of COVID-19.

		Stress	Deal Duration	Age	Experience
Total Sleep Score	Correlation Coefficient	0.558[a]	0.210[a]	−0.190[a]	−0.206[a]
	Sig. (2-tailed)	<0.001	0.001	0.002	0.001

[a] Correlation is significant at the 0.01 level (2-tailed). Spearman's rho was performed for statistical analysis.

we can say that the effect of the coronavirus outbreak on sleep difficulty has been mediated by stress made by the outbreak on physicians. An unpublished work-study conducted in the same region reported that most of the physicians (69.4%) have a moderate level of stress during the COVID-19 outbreak. In addition, the stress was escalated with increasing duration dealt with suspected/confirmed cases of COVID-19 [15].

Some other investigations have shown that both healthcare workers and severe acute respiratory syndrome (SARS) survivors develop mental health issues during the SARS epidemic [16,17].

This study did not find a significant difference in the sleep difficulty score of physicians with different specialties. But, the females had worse sleep status compared to the male physicians. It seems that the COVID-19 outbreak has made a substantial fear to the HCWs especially that an internist was found to be positive for the COVID-19 in this region. The significantly more sleep escalation in females is in agreement with the literature [9]. The majority of the general physicians (80.8%) and obstetrics and gynecologists (80.0%) were sleepless. The general physicians including junior and senior house officers and general practitioners attend the hospitals

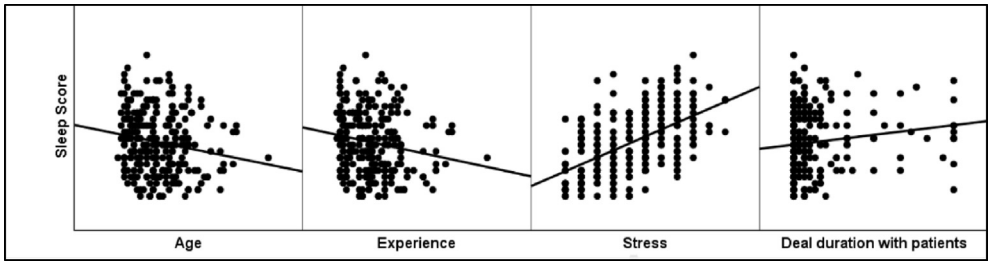

Fig. 2. Scatter plot of correlation of sleep with stress, deal duration with suspected/confirmed cases of COVID-19, experience, and age.

for the entire month. Therefore, they have dealt with a large number of patients with more possible contact or close contacts. While all obstetrics and gynecologists are females and have more working load in this region. In addition, 77.8% of the anesthetists and intensive care specialties were sleepless. We refer to the fear of infection by aerosol products due to intubation through deal more time with the patients. The probable reason for the stress and sleep difficulty of physicians during the COVID-19 outbreak is "hypochondriac concerns" or a concern about being infected by the coronavirus [18].

The physicians with more experience in medicine and older physicians had better sleep status. A similar pattern was found during the COVID-19 outbreak in China [9] and the SARS outbreak in Taiwan [19]. We did not assess the average time physicians spent focusing on the COVID-19 outbreak per day. Huang and Zhao [9] reported that the physicians who spent too much time ($\geq$3 h) focusing on the outbreak were more likely to develop anxiety. Maunder, Hunter [20] explained the psychological and occupational effects of the SARS in Toronto in a larger hospital in the first four weeks of the outbreak. They reported that 19 individuals developed SARS within a four week period; including 11 HCWs. The hospital established a leadership command team to present mental health support interventions. SARS patients reported fear, loneliness, boredom, and anger. The patients worried about the effects of quarantine and contagion on family members and friends and experienced anxiety and insomnia. The study reported that medical staff were affected by fear of contagion and of infecting family members, friends, and colleagues. They reported that emotional and behavioral reactions of staff and patients were understood to be the normal protective response to the stress made by the epidemic.

The mental health issues are needed to be suitably met since they have long-lasting impacts on HCWs [21]. Moreover, they may hinder the urgent response to this pandemic by escalating attention and decision-making [6]. The urgent appropriate strategies are required to strengthen the HCWs against mental health issues [22]. Managing mental health and psychosocial wellbeing during this pandemic is as important as managing physical health.

The World Health Organization [23] advises several coping strategies to address the psychological effects of the COVID-19 outbreak. These include rest and respite (during or between working shifts), sufficient eating and healthy food, physical activity activities, and staying in contact with family and friends. The COVID-19 outbreak is a unique and unprecedented scenario for many HCWs, particularly if they have not been involved in similar responses. The influences of the pandemic on psychiatric problems must not be overlooked.

3.1. Limitations of the study

The possible weaknesses of this study are that some medical specialties were not included, for example, psychiatrists. In addition, only one family and community medicine doctor was included in this study. Anyhow, we need to consider that participation in the study was completely voluntary. However, a strong point of this study that an acceptable response rate was obtained.

3.2. Conclusions

This study revealed that most of the physicians are sleepless during the COVID-19 outbreak. They had slightly insufficient sleep duration and unsatisfactory quality of sleep with slightly decreased physical and mental functioning during the day. The sleep of the physicians was escalated by increasing the number of days that they deal with the suspected or confirmed cases of the COVID-19 and stress level in the general hospitals.

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Conflict of interest

The authors do not report any conflict of interest.

The ICMJE Uniform Disclosure Form for Potential Conflicts of Interest associated with this article can be viewed by clicking on the following link: https://doi.org/10.1016/j.sleepx.2020.100017.

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Authorship

The corresponding author declares that all authors have sufficiently participated in study design, assessment, review, data collection, analysis, and interpretation.

References

[1] Wang C, Horby PW, Hayden FG, et al. A novel coronavirus outbreak of global health concern. Lancet 2020;395:470–3.
[2] Fiorillo A, Gorwood P. The consequences of the COVID-19 pandemic on mental health and implications for clinical practice. Eur Psychiatr 2020:1–4.
[3] Kang L, Li Y, Hu S, et al. The mental health of medical workers in Wuhan, China dealing with the 2019 novel coronavirus. Lancet Psychiatry 2020;7:e14.
[4] Brooks SK, Webster RK, Smith LE, et al. The psychological impact of quarantine and how to reduce it: rapid review of the evidence. Lancet 2020;395(10227):912–20.
[5] Shigemura J, Ursano RJ, Morganstein JC, et al. Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: mental health consequences and target populations. Psychiatr Clin Neurosci 2020;74(4):281.
[6] Cabello IR, Echavez JFM, Serrano-Ripoll MJ, et al. Impact of viral epidemic outbreaks on mental health of healthcare workers: a rapid systematic review. medRxiv 2020. Unpublished manuscript.
[7] Chen R, Chou K-R, Huang Y-J, et al. Effects of a SARS prevention programme in Taiwan on nursing staff's anxiety, depression and sleep quality: a longitudinal survey. Int J Nurs Stud 2006;43:215–25.

[8] World Health Organization. Coronavirus disease 2019 (COVID-19). Situation report – 70. WHO; 2020.
[9] Huang Y, Zhao N. Generalized anxiety disorder, depressive symptoms and sleep quality during COVID-19 epidemic in China: a web-based cross-sectional survey. medRxiv 2020;288:1–6.
[10] Shahid A, Wilkinson K, Marcu S, et al. STOP, THAT and one hundred other sleep scales. London: Springer Science+Business Media, LLC 2012; 2012.
[11] Soldatos CR, Dikeos DG, Paparrigopoulos TJ. Athens Insomnia Scale: validation of an instrument based on ICD-10 criteria. J Psychosom Res 2000;48:555–60.
[12] Azzez SS, Abdulah DM, Piro RS, et al. Sleep severity and fatigue manifestations in relation to the doctor–patient relationship. Sleep Med 2019;58:13–7.
[13] Besedovsky L, Lange T, Born J. Sleep and immune function. Pflueg Arch Eur J Physiol 2012;463:121–37.
[14] Lange T, Perras B, Fehm HL, et al. Sleep enhances the human antibody response to hepatitis A vaccination. Psychosom Med 2003;65:831–5.
[15] Abdulah DM, Mohammed AA. The consequences of the COVID-19 pandemic on perceived stress in clinical practice. Unpublished Work: University of Duhok; 2020. p. 1–16.
[16] Lee AM, Wong JG, McAlonan GM, et al. Stress and psychological distress among SARS survivors 1 year after the outbreak. Can J Psychiatr 2007;52:233–40.
[17] Lu Y-C, Shu B-C, Chang Y-Y. The mental health of hospital workers dealing with severe acute respiratory syndrome. Psychother Psychosom 2006;75:370–5.
[18] Furer P, Walker JR, Chartier MJ, et al. Hypochondriacal concerns and somatization in panic disorder. Depress Anxiety 1997;6:78–85.
[19] Su T-P, Lien T-C, Yang C-Y, et al. Prevalence of psychiatric morbidity and psychological adaptation of the nurses in a structured SARS caring unit during outbreak: a prospective and periodic assessment study in Taiwan. J Psychiatr Res 2007;41:119–30.
[20] Maunder R, Hunter J, Vincent L, et al. The immediate psychological and occupational impact of the 2003 SARS outbreak in a teaching hospital. CMAJ (Can Med Assoc J) 2003;168:1245–51.
[21] Maunder RG, Lancee WJ, Balderson KE, et al. Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. Emerg Infect Dis 2006;12:1924.
[22] Bao Y, Sun Y, Meng S, et al. 2019-nCoV epidemic: address mental health care to empower society. Lancet 2020;395:e37–8.
[23] World Health Organization. Mental health and psychosocial considerations during the COVID-19 outbreak. WHO; 2020.