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Effect of COVID-19 Pandemic on Sleep Quality and Mental State of Frontline Pulmonologists

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ABSTRACT

Introduction: This study aims to determine the sleep quality and its relationship with anxiety and depressive symptoms, working conditions and other factors among the frontline pulmonologists on active duty during the COVID-19 pandemic.

Method: An online survey was conducted among pulmonologists in Turkey. The survey link was e-mailed to the members of the professional societies of pulmonologists. The volunteers were asked to fill in questions about their sociodemographics, medical and psychiatric history, working and housing conditions, perceived levels of support during the pandemic, as well as the sleep habits before the pandemic. Also, questions investigating the severity/level of their worries were inquired and they were asked to fill in two scale forms (the Hospital Anxiety Depression Scale and Pittsburgh Sleep Quality Index-PSQI).

Results: The sample consisted of 179 pulmonologists who were divided into two groups according to PSQI as good sleepers (PSQI ≤5) and poor sleepers (PSQI >5). It was observed that 59.2% of the participants had poor sleep quality during the pandemic. Being anxious (p<0.0001, Odds ratio [OR]=0.139, 95% Confidence Interval [CI] [0.052–0.372]), working in intensive care unit (p=0.046, OR=2.363, 95% CI [1.015–5.497]), worry level about excessive increase of the number of patients above the capacity of the institution they worked in (p=0.018, OR=1.755, 95% CI [1.102–2.794]) and being dissatisfied with ones' sleep before the pandemic (p<0.016, OR=0.272, 95% CI [0.094–0.786]) were found to be the main factors that negatively affected the quality of sleep of pulmonologists during the pandemic.

Conclusion: More than half of the pulmonologists in our sample group had low sleep quality during the pandemic. For establishing a good sleep regime for clinicians, its crucial to consider certain interventions on the affecting factors.

Keywords: Anxiety, COVID-19, depression, pulmonologists, sleep

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INTRODUCTION

Coronavirus disease-19 (COVID-19) is characterized by its relatively easy transmission, high risk and even fatal risk of infection among healthcare workers. Healthcare providers responding to the pandemic are exposed to physical and psychological stressors that may cause severe mental health outcomes. The well-being of the healthcare professionals is very important for themselves, their families and also for the health system. The fast and worldwide spread of COVID-19 is challenging for the capacity to healthcare systems. Facing this critical situation, healthcare workers on the frontline who are directly involved in the diagnosis, treatment, and care of patients with COVID-19 are at risk of developing psychological distress and other mental health symptoms (1).

Previous studies have reported adverse psychological reactions among healthcare workers (2–5). There is growing body of evidence that those healthcare workers feared contagion and transmitting infection of their family, friends, and colleagues, felt uncertainty and stigmatization, reported reluctance to work or contemplating resignation, and reported experiencing significant number of symptoms of stress, anxiety, and depression, which could have long-term psychological implications (3, 6–8). Psychological impact might have long lasting effects and as well include post-pandemic symptoms (9).

Highlights

- **More than half of the pulmonologists experienced low sleep quality during the pandemic.**
- **Working in ICU is one of the main factors that negatively affect sleep quality.**
- **Being anxious is also an important factor that negatively affect sleep quality.**

Adverse effects of coronavirus pandemic on the mental health of frontline healthcare workers have been the primary concerns with insomnia, being one of the most reported symptoms. Sleep is adversely affected in frontline healthcare professionals involved in caring for COVID-19 patients as well as other healthcare providers working actively during pandemic (1,4,10).

It is important to be aware of impaired sleep quality and other sleep dysfunctions in medical staff. Impaired sleep may affect their decision

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making and performance at work. Sleep has a fundamental role in the regulation of emotions and physical homeostasis. Therefore, sleep disturbance can have direct consequences on both emotional functioning and physical and psychological well-being and may cause anxiety and depression (11). Improving sleep is crucial to prevent the short and long-term consequences of sleep disruption. As such, the aim of this study was to determine the sleep quality and its relationship with anxiety and depressive symptoms among frontline pulmonologist during the COVID-19 pandemic in Turkey. We hypothesized that there would be a relationship between the sleep quality and working conditions and a relationship between anxiety and depressive symptoms.

METHODS

We conducted an online survey among pulmonologists in Turkey. The survey link was e-mailed to the members of the professional societies of pulmonologists (Turkish Thoracic Society, Turkish Respiratory Society, and Lung Health and Intensive Care Society). The survey link was accessible from the beginning of the May to the end of June 2020 on which the COVID-19 related restrictions were loosened. Of the around 1800 pulmonologists those were reached via e-mail; 181 responded to the survey.

The volunteers were asked to respond to questions about their sociodemographic data, medical and psychiatric history, working conditions, housing conditions, perceived levels of support from family members, co-workers and friends during the pandemic as well as the pre-pandemic sleep habits. Also, 5-point Likert type questions were asked to investigate the severity/level of their worries about 1) transmitting the infection to the people, they live with, 2) shortage of their personal protective equipment (PPE), 3) being unable to reach the proper PPEs, 4) family's needs which cannot be met in case she/he gets sick, 5) children not being cared for, during working hours, 6) insufficient knowledge about COVID-19, 7) excessive increase of the number of patients above the capacity of the institution worked in, and 8) impaired quality of nutrition during working hours. In the last part of the survey, the volunteers filled in the two-scale forms (the Hospital Anxiety Depression Scale and Pittsburgh Sleep Quality Index). This study was performed in line with the principles of the Declaration of Helsinki and was approved both by the local ethics committee (date: 15.05.2020 and approval no: 20–5T/48) and The Ministry of Health COVID-19 Scientific Research Oversight Committee.

The Hospital Anxiety Depression Scale (HADS)

The scale is developed by Zigmond and Snaith (12). Its Turkish form's validity and reliability study was performed by Aydemir et al. (13). The scale is a self-report questionnaire with four-point Likert scale of 14 questions; seven items on anxiety items and the other seven on depression. According to the study in Turkish population, the cut-off point for anxiety and depression are 10/11 and 7/8 respectively.

Pittsburgh Sleep Quality Index (PSQI)

It is a self-report assessment tool to distinguish people experiencing sleep disorders from those with no sleep issues, which also serves to identify sleep problems and determine quality of sleep (14). Nineteen of the 24 questions in the scale are self-report questions, and five questions are directed to spouses or roommates. Turkish validity and reliability study was performed by Agargün et al. (15). Total score takes a value between 0–21. Higher total score indicates poorer sleep quality. If the total score of the scale is greater than 5, it indicates poor sleep quality.

Statistical Analysis

The statistical analysis was performed using IBM Statistical Package for the Social Sciences (SPSS) Version 25. We used Shapiro Wilk test for normality testing. Quantitative variables which had normal distribution were expressed by mean and standard deviation and the variables which had skewed distribution were expressed by median and minimum-maximum levels. Categorical variables were given in numbers and percentages. Chi-square test was conducted to compare categorical variables. For the comparison of the quantitative variables, Student's t-test was used for the variables with normal distribution and Mann-Whitney U test was used for variables with skewed distribution. Spearman's rank test was used to assess correlations between continuous variables. Factors that might be associated with sleep quality were further investigated using regression analysis. The significance level of ≤0.05 was accepted for all hypotheses.

RESULTS

Sample Characteristics

One hundred and eighty-one pulmonologists completed the survey, two subjects were excluded because of answers missing on PSQI. Hence, the sample consisted of 179 pulmonologists. Table 1 shows the main characteristics of the study population. One hundred and twenty-seven (70.9%) pulmonologists were working also at night shifts.

Sleep Characteristics

When the participants were divided into two groups as good sleepers (PSQI ≤5) and poor sleepers (PSQI >5), it was observed that the sleep

Table 1. Characteristics of the study cohort

Total number of participants	179
Age (years), median (range)	42 (25–65)
Female	126 (70.4%)
Marital status	
Married or living with a partner	134 (74.9%)
Single	35 (19.6%)
Divorced/Separated	9 (5.1%)
Widowed	1 (0.6%)
Living with children in the same house	101 (56.4%)
Chronic disease	57 (31.8%)
Prior psychiatric treatment	32 (17.9%)
Daily consumption of caffeinated beverages	
Less than one cup of coffee	34 (19%)
1 cup of coffee	61 (34.1%)
2 to 3 cups of coffee	71 (39.7%)
4 or more cups of coffee	13 (7.3%)
Increased coffee consumption after pandemic	49 (27.4%)
Experience as pulmonologist (years), median (range)	13 (1–35)
Total weekly working hours, median (range)	40 (3–96)
Working in a teaching hospital	140 (78.2%)
Night shifts	
Yes	71 (39.6%)
On call	56 (31.3%)
No	52 (29.1%)
Working in a hospital with a specialized respiratory ICU	90 (50.3%)
Taking care of ICU patients	84 (46.9%)
Sleep problems during 3 months before pandemic	
None	68 (38%)
Less than once a week	69 (38.5%)
Once or twice a week	21 (11.7%)
Three or four nights a week	11 (6.2%)
More than five nights a week	10 (5.6%)

*Data are expressed as n (%), unless otherwise stated. ICU: Intensive Care Unit

Table 2. Demographic characteristics and working conditions of the good and poor sleepers

	Good Sleepers (PSQI ≤5) (n=73)	Poor Sleepers (PSQI >5) (n=106)	Statistics
Age (years) (median, range)	48 (25–65)	38.5 (25–65)	p=0.001 Z=-3.214
Female (n, %)	47 (64.4%)	79 (74.5%)	N. S.
Professional experience (median years, range)	20 (1–33)	10.5 (1–35)	p=0.004 Z=-2.856
Working in a training hospital (n, %)	60 (42.9%)	80 (57.1%)	N. S.
Working in ICU (n, %)	25 (29.8%)	59 (70.2%)	p=0.005 χ^2=7.959
Working also at nights (n, %)	39 (36.1%)	69 (63.9%)	N. S.
Working time (median hours/week, range)	40 (3–80)	40 (4–96)	p=0.008 Z=-2.656
Maximum shift duration (median hours, range)	9 (3–55)	12 (2–40)	p=0.261 Z=-1.124
Having children (n, %)	56 (76.7%)	62 (58.5%)	p=0.018 χ^2=5.604
Accommodating away from home (n, %)	5 (20.8%)	19 (79.2%)	p=0.056 χ^2=3.663

ICU: Intensive Care Unit; PSQI: Pittsburgh Sleep Quality Index

quality of 59.2% of the participants was poor during the pandemic. In first level statistical analysis, we found poor sleep was associated with such variables as young age, less professional experience, working in the intensive care unit (ICU), increased weekly working hours, higher anxiety and depression scores (Table 2 and 3). The comparison of the characteristics and working conditions of the poor and good sleeping groups are given in Table 2.

In the whole sample 122 participants (68.2%) were found to have anxiety risk and 69 (38.5%) had depression risk according to HADS. Pulmonologists who had anxiety or depression risk were more likely to have poor sleep (p<0.001) (Table 3).

The comparison of primary reasons for worry and perceived support levels are presented in Table 4. The highest rated worries in the whole sample included concerns about transmitting the infection to the people they live with (median=4), about family needs which cannot be met in case one gets sick (median=3), and concerns about PPE shortage (median=3). The lowest rated worry was about childcare (median=1). The median rating of the remaining worries was 2. The highest rated perceived social support was about family support (median=10). Median perceived social support levels from co-workers and friends were equal and rated 8.

Subgroup Analysis

In the poor sleepers group, the ratio of pulmonologists who had also sleep problems prior to the pandemic were higher (p=0.001, χ^2=11.942). Of the 42 pulmonologists who were not satisfied with their sleep before the pandemic, poor quality of sleep for 35 continued, also, after the pandemic.

A further statistical analysis was made, also, with a subgroup of 137 physicians who were satisfied with their sleep before the pandemic. Of the 137 physicians, 66 continued to have good sleep quality (48.2%), whereas 71 (51.8%) of them became poor sleepers after the pandemic. Working in ICU was related to poor sleep quality after the pandemic (p=0.019) in this subgroup as well. Anxiety and depressive symptoms were significantly associated with poor sleep quality (p<0.001 for both) in this subgroup.

Regression Analysis

Binary logistic regression analysis was performed to gauge the combined impact of variables which were found to be associated with sleep quality. Accommodating away from home showed a clear tendency to significance

Table 3. The Hospital Anxiety Depression Scale scores of the good and poor sleepers

	Good Sleepers (PSQI ≤5) (n=73)	Poor Sleepers (PSQI >5) (n=106)	Statistics
Anxiety score, median (range)	6 (0–17)	11 (3–21)	p<0.001 Z=-7.467
Depression score, median (range)	6 (0–19)	11 (2–19)	p<0.001 Z=-5.804
High risk for anxiety disorder, n (%)	30 (41.1%)	92 (86.8%)	p<0.001 χ^2=39.514
High risk for depression, n (%)	15 (20.5%)	54 (50.9%)	p<0.001 χ^2=39.514

PSQI: Pittsburgh Sleep Quality Index

Table 4. Self-reported worry scores and perceived support levels of the good and poor sleepers

	Good Sleepers (PSQI ≤5) (n=73)	Poor Sleepers (PSQI >5) (n=106)	Statistics
Worry Type*	**Median score (range)**	**Median score (range)**	
Transmitting the infection	4 (1–5)	4 (1–5)	p=0.027 Z=-2.217
Shortage of PPE	3 (1–5)	3 (1–5)	p=0.019 Z=-2.344
Unavailability of proper PPE	2 (1–5)	2 (1–5)	p=0.076 Z=-1.772
Concerns about failure to satisfy family needs	3 (1–5)	4 (1–5)	p=0.014 Z=-2.466
Children not being cared for	1 (1–5)	1 (1–5)	p=0.534 Z=-0.622
Insufficient knowledge about COVID-19	2 (1–5)	3 (1–5)	p=0.004 Z=-2.907
The number of patients exceeding institutional capacities	2 (1–4)	2 (1–5)	p<0.001 Z=-4.322
Impaired quality of nutrition during workhours	2 (1–5)	3 (1–5)	p<0.001 Z=-5.127
Perceived support levels**	**Median score (range)**	**Median score (range)**	
From family	10 (0–10)	10 (0–10)	p=0.691 Z=-0.398
From co-workers	8 (2–10)	7 (0–10)	p=0.001 Z=-3.350
From friends	8 (0–10)	8 (0–10)	p=0.008 Z=-2.642

PPE: Personal Protective Equipment; PSQI: Pittsburgh Sleep Quality Index
*Participants were required to rate their worries between 1 and 5 where 1 represents the lowest and 5 represents the highest level of worry.
** Participants were required to rate their perceived social support level between 1 and 10 where 1 represents the lowest and 10 represents the highest level of support.

Table 5. Odds ratios (OR) and confidence intervals (CI) of variables which have a significant association with poor sleep

Factors	OR	95% CI	p value
Working in the ICU	2.363	1.015–5.497	0.046
Worry level about increase of the number of the patients exceeding institutional capacity	1.755	1.102–2.794	0.018
No anxiety disorder risk	0.139	0.052–0.372	p<0.001
Good sleepers before the pandemic	0.272	0.094–0.786	0.016

CI: Confdence interval; ICU: Intensive Care Unit; OR: Odds Ratio

in the first level analysis (p=0.056), that's why it was also included in the regression model. Results of the regression analysis denoting an association with sleep quality is presented in Table 5. The effect of age, parenthood, professional experience in years, average working time per week, presence of a high risk for depression, worries about transmitting the infection to people they live with, worries about the shortage of PPE, worries about family's needs which cannot be met in case one gets sick, worries about insufficient knowledge on COVID-19, worries about the quality of nutrition during working hours, perceived levels of support of co-workers and friends and accommodating away from home lost their significance. Working in the ICU, level of worries about excessive increase of the number of patients beyond institutional capacities, having anxiety disorder risk and having unsatisfying sleep prior to the pandemic were found to have negative effects on sleep quality.

DISCUSSION

We investigated the sleep quality and associated factors among frontline pulmonologists during the COVID-19 pandemic. Being anxious, working in the ICU, worries about excessive increase of the number of patients beyond institutional capacities and dissatisfaction with ones' sleep before the pandemic are the main factors that negatively affect the quality of sleep for pulmonologists during the pandemic.

Sociodemographic Factors

Among the sociodemographic variables only younger age and lesser years of professional experience were found to be related to poor sleep quality, but with logistic regression analysis these two factors have also lost their significance. As females are more prone to anxiety and depression, we also expected them to have more sleep problems. However, we found no difference between the groups in terms of gender. In line with our results, studies investigating the sleep quality or insomnia symptoms reported no significant impact of such factors as age and gender on quality of sleep (3,8,16–18)

Working Conditions That Negatively Affect Sleep Quality

In contrast to what we expected, we found no differences with the quality of sleep of physicians working in night shifts. This might be due to the fact that clinicians were already used to working in night shifts at the very outset of their residency. So, their sleep patterns are well adapted to shift-work schedules.

We found that working in the ICU increased the risk of having poor sleep quality nearly two and a half times. Even among the group who were satisfied with their sleep quality before the pandemic, working in the ICU was found to be a risk factor for poor sleep. This is in line with the finding that ICU caregivers are negatively impacted in terms of anxiety and depression (19), as they interact reciprocally. There are several studies reporting worse psychological impact (i.e. increased risk of anxiety, depression, and poor sleep quality) on the healthcare professionals working in ICUs (20,21). Working as a pulmonologist in ICUs is a demanding work that requires making critical decisions about the most severely affected patients. It is quite expectable that those working in the ICU would be more prone to stress related outcomes such as sleep disorders, anxiety and depression.

Perceived Support

Despite losing its significance in regression analysis, in our first line analysis we found that levels of perceived support of co-workers and friends were significantly higher in good sleepers, in line with a study including 180 medical staff treating COVID-19 patients in China (22). It is noteworthy that the support level of friends manifested a possible trend toward significance in the regression analysis. Sample size may be the reason of non-significance. In our study perceived support from family was very high in both groups, this might be related to our cultural attitudes and close family bonding. Also increased social bonds during stressful situations might be an important reason. In the first line analysis, we found that doctors having children have better sleep quality than those who have not, it was contrary to our expectations that the presence of children might have led to increased home responsibilities; and unsurprisingly having children lost its significance in the regression analysis.

Doctors in both groups did not report significant worries about children not being cared for, it could be related to the high level of perceived family support and intense bonds about caring for children. Having social support was reported as a protective factor for mental health problems during the pandemic (23,24). Also, a cross sectional survey study including 1970 participants from public and healthcare workers reported 'insufficient social support' as a risk factor for depression, anxiety, and sleep problems among healthcare workers (2).

Self-Reported Worries

Self-reported worry scores about 'transmitting the infection,' 'shortage of PPE,' 'concerns about failure to meet family neds,' 'insufficient knowledge about COVID-19,' 'having to service such number of patients as beyond institutional capacities' and 'impaired quality of nutrition during workhours' were significantly higher in the poor sleeping group.

Although, except for the worry about the increased number of patients, those worries lost their significance in regression analysis, we think that all these worries might be a predisposing factor for anxiety risk which is directly related to sleep quality. The review of literature pointed out the main concerns of healthcare professionals as anxiety regarding patient care, possibility of transmitting the infection to home environment and families, and inability to have access to PPE (25). Due to preventive restrictions, hospital cafeteria facilities were closed nationwide in the beginning of the pandemic, hospital staff were given meal boxes which were less sufficient than usual meals. This might have caused higher worries about impaired quality of nutrition at the very beginning of the pandemic. We found that the frontline healthcare workers' concern about the number of the patients directly impacted their sleep quality. This is an unsurprising finding because the first case is diagnosed in Turkey after several months of the outbreak, during those several months the healthcare workers in Turkey were exposed to disappointing news from other countries, that the hospital beds were not enough for taking care of the patients and doctors were also under the burden of critical decision-making about the distribution of health facility resources.

Anxiety and Depression

Anxiety and depressive symptoms are factors that affect sleep quality. We found both anxiety and depression scores on HADS and anxiety/depression risks were calculated significantly higher among poor sleepers. After logistic regression analysis, depression risk lost its significance but being anxious remained as one of the risk factors for poor sleep quality. The relationship between sleep and anxiety or depression are bidirectional. Bad sleep might precipitate anxiety and mood disorders. Also sleep quality is mostly negatively affected by anxiety and depression (26,27). This finding is in line with Lin et al. findings that frontline healthcare workers correlated significantly with anxiety, depression and insomnia (10). In a study comparing frontline healthcare workers with non-frontline healthcare workers in terms of mental health, frontline workers are found to experience higher anxiety, depression, and sleep problems (28).

According to a recent meta-analysis, the short-term mental health effects of the pandemic are equally high across different populations. However, reports of insomnia and sleep problems are significantly higher among health care workers than the general population (29). Also, compromised sleep may affect the immune system and might make the frontline physicians vulnerable to COVID-19 (30). Sleep is also important in maintaining attention, which is one of the key cognitive functions for those clinicians having to make critical decisions about patients (11). That's why, sleep problems among frontline physicians must be handled thoroughly to prevent further morbidity.

Limitations

One of the limitations of this study is the small sample size compared to all pulmonologists in Turkey. However, we tried to send the survey by e-mail to the members of three largest professional societies of pulmonologists. Also, we did not have the opportunity to make an objective assessment of sleep quality, anxiety, and depression before the pandemic but even so the sleep habits before the pandemic were evaluated in the survey. Collection of self-reported data was also a limitation the psychiatric symptoms of which we were not able to clinically assess, whereas it was impossible to make a face-to-face assessment of the frontline healthcare workers during the pandemic.

In conclusion, we found that working in ICU, being worried about excessive increase of the number of the patients beyond the institutional capacity of the institution concerned, having poor sleep prior to the pandemic and having anxiety disorder risk are the main factors affecting sleep quality in our study cohort -frontline pulmonologists. Good sleep quality is an important factor for human physical and mental well-being, especially those working in stressed conditions such as being a frontline health worker in a pandemic. To establish good sleep for the clinicians, it is crucial to regulate the working conditions; including, especially, a revision of the total working hours, having ICU responsibilities, if possible, in rotation with other care services, and strengthening the mental support systems such as counselling for frontline clinicians, making interventions to cope with anxiety and depression, stress management training and so on. Considering the bidirectional relationship between sleep disorders and mental health problems such as anxiety and depression, early detection of related symptoms and rapid interventions to prevent progression to clinically significant syndromes are very important for the well-being of physicians. As this COVID-19 pandemic is expected to last for a considerable time, further studies must be planned to investigate the mental effects of working as clinicians in such alarming conditions and further support strategies or interventions for reducing anxiety must be developed for frontline healthcare workers.

Ethics Committee Approval: This study was performed in line with the principles of the Declaration of Helsinki and was approved both by the local ethics committee (date: 15.05.2020 and approval no: 20–5T/48) and The Ministry of Health COVID-19 Scientific Research Oversight Committee.

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