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RESEARCH ARTICLE

The Investigation of musculoskeletal disorders, sleep quality, and fatigue of frontline healthcare workers during the COVID-19

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Abstract
The purpose of the study is to compare musculoskeletal system complaints, fatique, and sleep quality in front-line and second-line healthcare worker trating COVİD-19 patients. 152 healthcare worker between the ages of 18 and 65 who worked in outpatient clinics, services, COVİD-19 units, or administrative management were included in this study. Healthcare worker who had mission in the diagnosis, treatment, and isolation of patients diagnosed with COVİD-19 were determined as front-line workers (26F, 45M) and healthcare worker who didn't have this kind of mission were defined as second-line workers (40F, 41M). After the collection of the participants "demographic data" the Nordic Musculoskeletal Questionnaire (NMQ), the Fatique Severity Scale (FSS), and the Jenkins Sleep Scale (JSS) were used to assess the participant musculoskeletal pain, fatique, and sleep quality, respectively. A significant difference was found in the training time, job experience, and number of weekly shifts of healthcare workers working on the front-line healthcare workers compared to operating the second-line healthcare workers ($p \leq 0.05$). Front-line healthcare workers reported more neck and back pain, while second-line healthcare workers reported more lower back pain. It was found that front-line healthcare workers had higher levels of fatique severity ($t(150)$: 4.264, $p \leq 0.001$, Cohen's d:0.69), lower levels of sleep quality ($t(150)$: 4.479, $p \leq 0.001$, Cohen's d:0.72). Shift programs should be arranged to reduce fatique and sleep problems of front-line healthcare workers, and protective neck and back muscles exercise programs should be given for front and second-line healthcare workers.

Keywords
COVID-19, Health Workers, Pain, Sleep, Fatigue

INTRODUCTION

In Wuhan, China, cases of pneumonia with an unknown etiology which is now known as COVID-19 have been reported since December 2019 (Li et al., 2020). COVID-19 outbreaks were recorded in the following weeks, and on March 11, 2020, the World Health Organization (WHO) declared the COVID-19 epidemic a global pandemic (Preti et al., 2020). The COVID-19 pandemic led to an excessive hospital overload, a severe shortage of healthcare resources, and an increase in professional workload (Miller et al., 2020). People have been affected due to the pandemic's psychosocial and physical factors. These factors, particularly for healthcare workers, can lead to musculoskeletal disorders.

In the development of low back, neck, and shoulder musculoskeletal disorders, physical and psychosocial workplace factors are crucial (Oude Hengel et al., 2011). Neck and back problems are the most prevalent musculoskeletal system complaints, and individuals who are front-line health workers experience more discomfort than

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others (Arca et al., 2021). Additionally, prolonged workdays and demanding workloads may cause high levels of mental stress and fatigue at work, which may aggravate musculoskeletal disorders (Feng et al., 2016; Tan et al., 2014; Yan et al., 2013). Healthcare professionals report feeling extremely tired and stressed, in addition to worrying about getting sick (The Lancet, 2020). As a consequence of this circumstance, it can be seen sleep disturbances in healthcare workers.

The frequent night shifts, on-call duties, and stress experienced by healthcare workers were frequently known to trigger insomnia and exhibit symptoms of sleep deprivation (Geoffroy et al., 2020; Wu & Wei, 2020). Sleep problems, such as low sleep quality, are common in the healthcare workers because of to high level of workplace stress (Sagayadevan et al., 2017; Thichumpa et al., 2018). Sleep problems among healthcare workers were found between 34-36% during the COVID-19 pandemic (Zhang et al., 2021). Understanding the epidemiology and correlation among health professionals is essential before developing protective measures and alleviating the adverse effects of poor sleep quality (Buysse et al., 1989).

The Covid 19 outbreak has increased the workload of healthcare workers, and this increased workload has had a negative impact on them (Campbell et al., 2001; Chen et al., 2005; Nickell et al., 2004; West et al., 2011). There are few studies investigating the level of fatigue, pain, and sleep of healthcare workers treating Covid patients during the pandemic (Abbas et al., 2021; Dong et al., 2019; Kurtaran et al., 2022; Tengilimoglu et al., 2021). The present study has the potential to develop solutions to improve the conditions of front-line healthcare workers. The aim of the study is to analyze musculoskeletal pain, fatigue, and quality of sleep in healthcare workers who work in front-line and second-line during the pandemic.

MATERIALS AND METHODS

Participants and Procedures

This is a cross-sectional study carried out in private and public hospitals in Adana and nearby provinces. Healthcare workers between 22 to 65 years old who apply treatment, care, and rehabilitation to patients were enrolled in the study. Healthcare workers who are not actively working due to any leave and filling online forms incomplete are exclusion criteria. The study was found ethically appropriate with the decision numbered 61351342/June 2021-07 Non-Invasive Research Ethics Committee of Üsküdar University.

Study Development and Measurements

One Hundred fifty-two healthcare workers who were involved in the administration participated in the study as volunteers in an outpatient clinic, service, Covid-19 unit, or administrative center. They were divided into 2 groups based on their working conditions for this study. One group is front-line healthcare workers who treated, identified, and isolated diagnosed patients with COVID-19 and the other group is second-line healthcare workers who weren't involved in the diagnosis or treatment. There were 45 males and 26 females in the front-line group. There were 40 females and 41 males in the second-line group.

The Demographic Information Form, Nordic Musculoskeletal System Questionnaire (NMQ), Fatigue Severity Scale (FSS), and Jenkins Sleep Scale (JSS) were used to evaluate the participants for the study. Google Forms was used to create the evaluation form. The information was collected by reaching through social media, mail, or smartphone applications (such as WhatsApp, Beep, etc.) Online questionnaires were distributed from smartphone applications from June 2021 to December 2021.

1- Demographic Information Form (Independent Variables)

This form included questions for demographic information. With this form, we recorded gender, age, education, which department he/she works, how many shifts he/she has in a week, how many hours he/she works, which sector he/she works, weight, and height situation.

2- Nordic Musculoskeletal Questionnaire (Dependent Variables)

Nordic Musculoskeletal Questionnaire has Turkish validity and reliability (Kahraman et al., 2016). The NMQ includes standardized questions to evaluate generalized shoulder, neck, and waist musculoskeletal disorders. It evaluates nine different anatomical areas, including the neck, shoulder, elbow, wrist, upper body, lower body, hip, thigh, knee, and ankle/foot, as well as a subjective assessment (pain, discomfort, inconsistency). Scores range from "1-very light" to "10-unbearable" for each body region. If a patient's pain scale increases above a six-point

threshold, there may be a problem with the musculoskeletal system.

3- Fatigue Severity Scale (Dependent Variables)

The Fatigue Severity Scale has Turkish validity and reliability (Gencay-Can & Can, 2012). The cut-off value has been established as 4 and above for patients on a scale with 9 items that he can apply himself. Each item is scored on a range of 1–7 (1= strongly disagree, 7= strongly agree), and the total score is the average of the 9 items it is calculated by taking into account pathological fatigue. The less fatigue the lower the general score.

4- Jenkins Sleep Scale (Dependent Variables)

Jenkins Sleep Scale has Turkish validity and reliability (Duruöz et al., 2018). 4 questions make up this survey, which was performed over the past four weeks and evaluates sleep problems: A tough time falling asleep, a tough time staying asleep, a lot of nighttime awakenings, and an exhausted feeling when you wake up. The Likert scale has six categories: no = 0, 1-3 days = 1, 4-7 days = 2, 8-14 days = 3, 15-21 days = 4, 22-28 days = 5, and so on the total rating ranges from 0 to 20, and an increase indicates sleep disturbance.

Statistical Analysis

The data obtained was loaded into the SPSS v26.0 statistical package. Descriptive statistics were given by frequency, percentage, mean, standard deviation, minimum, and maximum scores. Normality distribution tests were used in the data analysis. The Kolmogorov-Smirnov test was used and the assumptions of normality were made as a result of the analysis, as parametric tests were used because they were provided. The pain scores of the participants were given as a percentage. The relationship between the 2 categorical variables chi-square test was used and to compare 2 independent groups the independent sample t-test was used. The p-value was accepted at a significance level of 0.05.

RESULTS

Participants were divided into 2 different groups (front-line n: 71, second-line n: 81) according to COVID-19 proximity levels at the time of working. The distribution of gender and the Body Made Index (BMI) (p>0.05) was similar in both groups. But, age, educational level, and experience were significantly different between the two groups. Front-line workers were older, experienced, and highly educated. The demographics of the groups are shown in Table 1.

Table 1. Demographic characteristics of participants

		Front-line (n=71)		Second-line (n=81)		
		Mean ± SD	Min - Max.	Mean ± SD	Min - Max.	p
Education level (year)		17.14±2.57	5-21	15.89±2.74	5-21	**0.004****
Experience (year)		15.23±10.61	1-34	8.68±9.14	1-44	**0.000*****
BMI (kg/m^2)		25.47±3.53	20.9-40.4	24.90±5.55	18.3-63.8	0.461
		n	%	n	%	p
Gender	Men	45	63.4	41	50.6	0.113
	Women	26	36.6	40	49.4	
Age	18-25 years	7	9.9	28	34.6	**0.002****
	26-30 years	14	19.7	15	18.5	
	31-40 years	18	25.4	22	27.2	
	41-50 years	15	21.1	10	12.3	
	51-60 years	17	23.9	4	4.9	
	61-65 years	0	0.0	2	2.5	
Number of shifts for a week	Absent	21	29,6	68	84,0	**0,000*****
	Less than 3	43	60,6	9	11,1	
	Much than 3	7	9,9	4	4,9	
Working hours for a week	Less than 48 hours	33	46,5	44	54,3	0,335
	Much than 48 hours	38	53,5	37	45,7	

BMI: Body Made Index, * p value is significant at the 0.05 level, ** p value is significant at the 0.01 level.

Front-line workers had significantly more pain in all their joints for the past 12 months and the past 1 week ($p<0.05$). It was determined that 7-8 out of 10 front-line healthcare workers experienced neck, shoulder, back, and waist pain/discomfort in the last 1 year (table 2).

Table 2. Frequency of musculoskeletal pain and discomfort in joints

	Front-line (n=71)			Second-line (n=81)		
	Have you at anytime during the last 12 months had trouble (ache, pain, discomfort, numbness)	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble?	Have you had trouble during the last 7 days	Have you at anytime during the last 12 months had trouble (ache, pain, discomfort, numbness)	During the last 12 months have you been prevented from carrying out normal activities (e.g. job, housework, hobbies) because of this trouble?	Have you had trouble during the last 7 days
	%	%	%	%	%	%
Neck	**81.7**	29.6	**59.2**	**51.9**	**24.7**	**29.6**
Shoulder	74.6	19.7	46.5	46.9	**24.7**	27.2
Elbow	46.5	21.1	25.4	27.2	17.3	16.0
Waist/Hand	52.1	19.7	35.2	34.6	19.8	17.3
Back	**80.3**	**31.0**	**63.4**	**64.2**	**35.8**	**46.9**
Low Back	**77.5**	**39.4**	**60.6**	**65.4**	**40.7**	**54.3**
Hip/ Thigh	59.2	22.5	42.3	34.6	18.5	16.0
Knee	59.2	23.9	45.1	37.0	23.5	17.3
Ankle/Foot	57.7	**32.4**	46.5	30.9	19.8	18.5

Front-line workers were found to have significantly more fatigue and sleep problems withth moderate effect size (Cohen's d: 0.69 and 0.72 respectively), (Table 3).

Table 3. Fatigue and sleep problem scores

	Front-line (n=71)		Second-line (n=81)		t	p
	$\bar{X}$	SS	$\bar{X}$	SS		
Fatigue	47.97	11.28	39.51	12.97	4.264	**0.000*****
Sleep Problems	10.94	5.45	7.19	4.89	4.479	**0.000*****

Independent Sample t-test. *p≤0.05. **p≤0.01. ***p≤0.001

DISCUSSION

The aim of the current study was to investigate musculoskeletal pain, fatigue, and quality of sleep in front-line and second-line health care workers. We found that both groups had musculoskeletal pain in particular areas. Front-line health care workers reported more neck pain and secondary care workers reported more back pain. Front-line healthcare workers had higher fatigue levels and worse sleep quality.

In our study, the front-line healthcare workers were older, had high professional training, and their work shifts were significantly higher than second-line healthcare workers. Old age and high shift count are independent risk factors for musculoskeletal problems, fatigue, and sleep problems (Bowey-Morris et al, 2011; Sagayadevan et al., 2017). In our study, the participants were divided into two groups based on their working conditions. Due to the nature of the study, no attempt was made to keep the demographic variables of the two groups similar. Responding to COVID patients requires advanced professional training. For this reason, front-line healthcare workers may be older and more experienced.

One of healthcare workers' occupational health hazards is musculoskeletal diseases

(Caillard & Iwatsubo, 2000). One of healthcare workers' occupational health hazards is musculoskeletal diseases (Caillard & Iwatsubo, 2000). In our research, neck pain was frequent among front-line healthcare workers, while second-line healthcare workers were likelier to experience lower back pain. Healthcare workers usually have musculoskeletal pain in the neck, shoulder, wrist, hand regions, and lower back (Feng et al., 2016; Palalı et al., 2021; Arca et al.,2021).

Associated factors for musculoskeletal disorders could be workload, heavy and awkward lifting, bending or twisting the neck, bending the trunk often, walking or standing a long time, and maintaining shoulder abduction (Dong et al., 2019). Because protective clothing restricts movement and adds weight, it's possible that wearing it while combating COVID-19 caused workers' back pain to worse (Kurtaran et al., 2022). In the current study front-line and second-line healthcare workers had pain in particular areas. Front-line workers had more pain around the neck and second-line health workers had more pain around the low back. Front-line health workers use their upper extremities more frequently during they serve COVID-19 patients. For this reason, they may have more neck problems.

In our study, front-line healthcare workers' fatigue level was higher. The literature shows that healthcare workers have apparently high levels of stress, fatigue, and depression symptoms (Belastungen & Beschäftigten, 2020; Lai et al., 2020; Sertel et al., 2022). In the current study, front-line healthcare workers were older, and have many weekly shifts. These factors may have caused front-line healthcare workers to feel more fatigued.

Our study indicated that front-line healthcare workers had worse sleep quality than second-line healthcare workers. According to the literature, front-line healthcare workers frequently had poorer sleep quality and a higher prevalence of sleep disturbance (Qi et al., 2020; Alshekaili et al., 2020). Chinese researchers reported that 47 out of 123 healthcare workers experienced sleep disturbances (Wang et al., 2020). In the current study, front-line healthcare workers' quality of sleep was bad. The possible reason for this could be excessive workload, weekly shifts, and fatigue level.

Limitations of the Study

Data were obtained from multiple hospitals via an online questionnaire. Health workers who had high complaints about the measurement tools of the study may have participated more. It is recommended to examine the musculoskeletal pain, sleep problems, and fatigue of front-line health workers at different working intensities.

Conclusion

Four out of 5 front-line workers and three out of 5 second-line workers reported experiencing neck, back, and low back pain. Front-line workers experienced higher levels of fatigue and worse sleep quality as a result of this study. The high number of weekly shifts may explain the high levels of pain, sleep disturbance, and fatigue experienced by front-line workers. A high weekly shift count is important as it is a modifiable factor.

Acknowledment

Authors thank all participants who participated in the study.

Conflict of interests

There is no conflict of interest in the present study.

Ethical Consideration

The research fieldwork was conducted with the online survey method after obtaining the ethics committee (Üsküdar University Non-invasive Clinical Research Ethics Committee, Number:06, Date:28/06/2021) approval and the institution's permission. Online consent was obtained from the participants.

Author Contributions

Study Design, TA, SG; Data Collection, SG; Statistical Analysis, TA, DD, SG; Data Interpretation, TA, DD, SG, AÖ; Manuscript Preparation, TA, AÖ, SG, DD; Literature Search, TA, AÖ, SG, DD. All authors have read and agreed to the published version of the manuscript.

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