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Evaluation of dyspnea severity and sleep quality in patients with novel coronavirus

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Abstract

Aim: Dyspnea, a common symptom of novel coronavirus, can negatively affect sleep quality. The aim of this study was to evaluate the relationship between dyspnea severity and sleep quality in patients with COVID-19.

Study Design: A cross-sectional design was used.

Methods: Using the researcher's mobile phone, data were collected via an online questionnaire from patients (n = 100) who agreed to participate in the study. The data-collection form comprised three parts: a patient descriptive information form, the Dyspnea–12 Questionnaire, and the Richards–Campbell Sleep Questionnaire (RCSQ).

Results: The mean age of patients was 46.39 ± 12.61 years and 66.0% were men. Patients who were treated in the intensive care unit had bachelor's degree or more and patients with comorbid diseases had low mean scores from the RCSQ and high mean scores from the Dyspnea–12 Questionnaire ($P < .001$, $P < .001$; $P = .047$, $P < .001$; $P < .001$, $P < .001$, respectively). Patients who were not receiving oxygen therapy had higher RCSQ mean scores and lower Dyspnea–12 Questionnaire scores ($P < .001$, $P < .001$; $P < .001$, $P < .001$, respectively). There was a strong negative relationship between the total scores obtained from the RCSQ and the Dyspnea–12 Questionnaire ($r = -.701$, $P < .001$).

Conclusions: Sleep quality is affected by dyspnea severity in patients with COVID-19. Sleep quality and dyspnea severity are also influenced by quite different factors, and these should be addressed and eliminated by nurses as part of a holistic approach. The results of this study will help nurses, especially those providing treatment and care for patients with COVID-19, to identify the factors affecting dyspnea and sleep quality and to plan, implement and evaluate nursing interventions that will reduce their workload.

1 | INTRODUCTION

In December 2019, a cluster of cases clinically similar to viral pneumonia but caused by a new coronavirus began to be identified in Wuhan, China. The World Health Organization (WHO) announced that the causative agent was a new type of coronavirus, which was labelled "novel coronavirus (COVID-19)," and declared a pandemic on 12 March 2020.[1]

After transmission through close contact with respiratory droplets, the virus enters the cells through the angiotensin-converting enzyme 2 (ACE 2) receptor and causes damage. As the ACE 2 receptor is distributed mainly in type 2 alveolar cells (AT 2 cells) in lung tissue, the primary target of COVID-19 in the human body is the lungs.[2] Therefore, the primary signs and symptoms observed in patients are those of viral upper respiratory disease such as fever, cough and dyspnea.[3]

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Dyspnea, a symptom seen in about 40% of patients, negatively affects quality of life by causing difficulty performing daily life activities as a result of sleep problems, increased care dependency, depression and anxiety.[4,5] Sudden or severe dyspnea in COVID-19 patients causes an increase in lung lesions, leading to further aggravation of the disease.[6] About 50% of COVID-19 patients with severe dyspnea have acute respiratory distress syndrome (ARDS), difficult-to-correct metabolic acidosis and coagulopathy, and a number of these may die in the first week after disease onset.[7]

New infectious diseases like severe acute respiratory syndrome (SARS) and COVID-19 affect patients not only physically but also psychologically, causing anxiety, depression and sleep disorders in the treatment process.[6,8] Sleep not only affects quality of life but also plays a role in preserving immune function and reducing the transmission of viral infections; it is also vital to maintaining mental well-being.[8,9] A decrease in sleep quality increases dyspnea by exacerbating pre-existing hypoxemia and hypercapnia, thereby increasing the patient's anxiety and depression levels.[10]

In the COVID-19 treatment process, patients are isolated, typically in intensive care units (ICUs).[6,11] Lai et al (2020)[12] reported that isolated individuals experienced high levels of depression, anxiety and stress; insomnia; and a decrease in their sleep quality. The required treatment of this highly contagious disease means that being alone for an extended time in a room increases these symptoms.[13] To provide personal and quality patient care and to manage dyspnea effectively, nurses should rate dyspnea severity and measure sleep quality in each COVID-19-positive patient and focus on the affecting factors. The aim of this study is to evaluate the relationship between dyspnea severity and sleep quality in patients with COVID-19.

What's known

- New infectious disease COVID-19 affects patients not only physically but also psychologically, causing anxiety, depression, and sleep disorders in the treatment process.
- Sleep not only affects quality of life but also plays a role in preserving immune function and reducing the transmission of viral infections; it is also vital to maintaining mental well-being.
- About 50% of COVID-19 patients with severe dyspnea have acute respiratory distress syndrome.

What's new

- Patients with COVID-19 were found to suffer from poor sleep quality, and the more severe patients' dyspnea was, the lower their sleep quality was.
- Dyspnea and sleep quality were affected by many factors in the pandemic survey.
- Elderly patients, patients with a comorbid disease, smokers, those who received continuous or intermittent oxygen therapy using non-invasive CPAP masks, and those hospitalized in the ICU had more severe dyspnea.

2 | METHODS

2.1 | Aims

This study was conducted to evaluate the relationship between dyspnea severity and sleep quality in patients with COVID-19.

2.2 | Research questions

What is the severity of dyspnea in patients with COVID-19?

How is the sleep quality of patients with COVID-19?

Is there a relationship between dyspnea severity and sleep quality in patients with COVID-19?

2.3 | Study design

This is a descriptive and cross-sectional study.

2.4 | Settings and sample of the study

Participants in this study were adult patients who were diagnosed with COVID-19 and received inpatient treatment in a training and research hospital. The population of this study was N = 122 patients. A total of 100 volunteer patients who met the following criteria participated: being in a COVID-19 clinic or in second-line intensive care where patients with COVID-19 were being treated between 1 and 30 June 2020; having spent at least one night in the hospital; being conscious (with a Glasgow Coma Scale score of 13 or above); being able to communicate verbally; having complained of dyspnea; and having no obstacles to participating in the study in terms of the treatment process. The presence of dyspnea, which is one of the inclusion criteria, was asked to the patients as "Have you ever had trouble in breathing after being diagnosed with COVID-19"? in the patient descriptive information form. Patients who stated that they had respiratory distress were included in the study. Also, researchers checked the oxygen saturation levels of the patients and patients with oxygen saturation below 90% once from the date of patient admission were included in the study.

Since COVID-19 is a new epidemic disease that first appeared in December 2019, there is, to the best of our knowledge, no study to date that has examined the relationship between dyspnea and sleep quality in patients with COVID-19. With no prior study to reference for calculating the sample, a power analysis of the study was performed with 100 patients by taking into consideration the number of questionnaire items. In a power analysis performed with a sample

size of 100 patients, the correlation between the Richards–Campbell Sleep Questionnaire (RCSQ) and the Dyspnea-12 Questionnaire was calculated as $r = .0703$; the effect size is 0.83; and the power of the study is 90% with a confidence interval of 95%.

2.5 | Data-collection tools

The data-collection form comprised three parts: a patient descriptive information form, the Dyspnea-12 Questionnaire and the RCSQ. Using the researcher's mobile phone, data were collected via an online questionnaire from patients (n = 100) who agreed to participate in the study. The researcher visited the clinic and intensive care unit, using personal protective equipment between 09.00 and 12.00 AM After informing the patients face to face, the researcher collected the data with an online questionnaire. The researcher informed the patients about the study after taking appropriate preventive measures and maintaining social distance. A link was sent to those patients who agreed to participate via an instant messaging application, and they completed the questionnaire in about 10-15 minutes after selecting the option "I was informed of and agree to participate in the study."

2.5.1 | Patient descriptive information form

The patient descriptive information form, the first part of the data-collection process, was developed by the researchers based on the literature review and included the following: gender, date of birth, educational level, name of clinic where the individual was admitted, the presence of any comorbid diseases, financial status, smoking status, whether the patient was receiving oxygen support therapy and, if so, which type, sleep habits, and whether the patient felt rested upon awakening.[6,14-16] The same treatment protocol were applied to patients who received COVID-19 treatment. In this scope, the following drugs were given to the patients: Favipiravir 200 mg 2 × 8 tablets first day; 2 × 3 tablets after 1st day, Paracetamol 500 mg tablet 1 × 1, Hydroxychloroquine Sulfate 200 mg tablet 1 × 1. In addition, antibiotics were added to the treatment plan of intensive care patients resulting from secondary infections.

2.5.2 | Dyspnea-12 questionnaire

This 12-item questionnaire was developed by Yorke, Moosavi, Shuldham and Jones[17] to measure the severity of dyspnea. The first seven items of this 4-point Likert-type scale (0 = none, 1 = mild, 2 = moderate, 3 = severe) ask patients about physical difficulties they experience because of dyspnea by evaluating the following factors: whether or not an inhaled breath goes throughout their lungs, if they have shortness of breath, if they have difficulty catching their breath, if breathing requires greater effort, if they feel like they are not getting enough air, if breathing causes discomfort, and if breathing is exhausting. The remaining five items of the questionnaire focus on the affective aspects of breathing such as depression, misery, distress, agitation, and irritation. The maximum scores for the physical and affective aspects of the questionnaire are 21 and 15, respectively. The minimum total score for the questionnaire is 0, whereas the maximum total score is 36. The higher the score, the more severe the dyspnea. The original study reported the Cronbach's alpha of this questionnaire as 0.90.[17] The adaptation of the Dyspnea–12 Questionnaire to Turkish and validity and reliability studies were conducted by Gok Metin and Helvacı,[16] who found Cronbach's alpha to be 0.97. In this study, Cronbach's alpha was found to be 0.99.

2.6 | Richards–Campbell Sleep questionnaire (RCSQ)

The RCSQ is a six-item questionnaire that assesses the depth of night sleep, sleep onset latency, frequency of awakenings, time spent awake after waking up, sleep quality and level of ambient noise. Scores in the range of 0-25 refer to "very poor sleep" and 76-100 to "very good sleep". Although, there is no cut-off value for poor and good, it was stated that the higher the score, the higher the sleep quality.[18] The adaptation of the RCSQ to Turkish and its validity and reliability studies were conducted by Ozlu and Ozer,[19] and Cronbach's alpha was found to be 0.91, showing that the RCSQ is a highly reliable questionnaire with internal consistency. In this study, Cronbach's alpha was found to be 0.93.

2.7 | Data analysis

The data were analyzed using SPSS 22 Statistics software package.[20] Number, mean, standard deviation, minimum, maximum, and frequency were used in the descriptive statistical analyses in the study. The data were tested for normal distribution using the Shapiro–Wilk test and skewness and kurtosis values. Student's *t* test, one-way ANOVA and Kruskal–Wallis tests were used to compare the questionnaire mean scores of two independent groups and three or more groups, respectively. Bonferroni correction was applied to determine which group caused the difference in the three-group comparison. To clarify which group caused the difference, the statistically significant differences were indicated in the tables using the superscripts "a, b, c, d" and codes such as "a-b, c" when three or more groups were compared. For example, the code "a-b, c" means that there is a statistically significant difference between the variable "a" and the variables "b" and "c" but no statistically significant difference between "b" and "c." The relationships between the total score for the RCSQ and the total score for the Dyspnea–12 Questionnaire and its sub-dimensions (physical and affective) were determined using the Pearson correlation analysis. The statistical significance was set at $P < .05$ in all tests.

2.8 | Ethical considerations of the study

The study was initiated after receiving approval from the local ethics committee of the Non-Interventional Research Ethics Committee of the faculty of health sciences of a university (Date:27.05.2020, No:0028) and written institutional permission from the training and research hospital where the study was conducted. The study was conducted in line with the principles of the Helsinki Declaration. Permission was received via e-mail from the authors who conducted validity and reliability studies of the Dyspnea–12 Questionnaire and the RCSQ.

3 | RESULTS

This study was completed with 100 patients diagnosed as COVID-19-positive; 33.0% were receiving care and treatment in the ICU and 67.0% in the clinics. Their mean hospital stay was 3.52 ± 1.64 days (Min:2, Max:12) (Table 1).

The patients' mean age was 46.39 ± 12.61 years, and 66.0% were men. Of 100 patients, 29.9% had Diabetes Mellitus and 60.0% were smokers. When the patients were evaluated in terms of oxygen therapy, it was found that 35.0% received intermittent oxygen therapy, while more than half (55.8%) received nasal cannula oxygen therapy (Table 1).

The patients' RCSQ mean total score was calculated as 46.76 ± 15.70 (Min: 6, Max: 92). For the Dyspnea–12 Questionnaire, mean total score was 12.34 ± 12.44 (Min: 0, Max: 36), and the mean scores for the physical and affective sub-dimensions were 7.26 ± 7.24 (Min: 0, Max: 21) and 5.08 ± 5.24 (Min: 0, Max: 15), respectively.

Those patients being treated in the ICU had a significantly lower RCSQ mean total score than those being treated in the clinic ($t = -7.591$, $P < .001$), and illiterate patients had a significantly lower RCSQ mean total score than those having a bachelor's degree or higher ($f = 2.741$, $P < .047$). Furthermore, the RCSQ mean total score of those who did not have a comorbid disease was significantly higher than those who had one ($t = 3.88$, $P < .001$); the RCSQ mean total score of those who could communicate with their family by phone was significantly higher than for those who could not ($t = -5.949$, $P < .001$); the RCSQ mean total score of those who reached the nurses by using the call button was significantly higher than those who called out to them ($t = 2.309$, $P < .023$). The RCSQ mean total score of the patients who did not receive oxygen therapy was significantly higher than for those who received continuous and intermittent oxygen therapy ($f = 33.862$, $P < .001$) and those who received oxygen therapy via nasal cannula, simple mask, and non-invasive continuous positive airway pressure (CPAP) ($f = 25.638$, $P < .001$) (Table 2).

The patients in the ICU ($t = 10.373$, $P < .001$), those in the age group 65 years and older ($t = 2.847$, $P < .05$), and those with comorbid diseases ($t = -7.119$, $P < .001$) had a statistically significantly higher mean total score on the Dyspnea–12 Questionnaire. It was found that the dyspnea scale was affected by the smoking status, and the difference was because of the difference in mean scores between smokers and non-smokers ($X^2 = 10.798$, $P = .005$). Furthermore, it was found that dyspnea severity varied depending on educational status, with those having a bachelor's degree or higher having a lower mean total score on the Dyspnea–12 Questionnaire than those who were unable to read or write and those who were primary-school graduates ($f = -6.260$, $P < .001$). When the Dyspnea–12 Questionnaire mean scores of the patients were compared in regard to the type and frequency of oxygen therapy, it was found that those who did not receive oxygen therapy had a significantly lower score than those receiving it either continuously or intermittently ($f = 70.912$, $P < .001$) and those receiving it via nasal cannula, simple mask, and non-invasive CPAP. Moreover, those who received oxygen therapy using non-invasive CPAP had a significantly lower score than those receiving it via nasal cannula and simple mask ($f = 115.074$, $P < .001$). No statistically significant differences were found between the mean total scores obtained from the RCSQ in terms of gender, age, smoking status and financial status ($P > .05$) (Table 3).

There was a statistically significant strong negative correlation between the total score for the Richards–Campbell Sleep Questionnaire and the total score for the Dyspnea–12 Questionnaire and its sub-dimensions (physical and affective) ($r = -0.701$, $P < .001$). It was also found that the higher the patients' dyspnea severity was, the lower their sleep quality was (Table 4).

4 | DISCUSSION

In this study, which was conducted to evaluate the relationship between dyspnea severity and sleep quality in patients with COVID-19, it was found that, among those patients whose sleep quality was poor, the more severe their dyspnea was, the lower their sleep quality was. In the previous studies, dyspnea was defined as "the permanent and progressive airflow limitation occurring as a result of the inflammatory response in the lungs".

and reported to be associated with numerous symptoms including cough, fatigue, sleep problems, anxiety and depression.[10,11,21]

In this study, more than half of the patients with COVID-19 were found to be men with comorbid diseases such as diabetes mellitus, chronic obstructive pulmonary disease (COPD), and hypertension. Thus, it can be hypothesized that the presence of a comorbid disease generally exacerbates patients' COVID-19 symptoms, leading to hospitalization for treatment. A similar patient population was reported in studies conducted in China,[22] the US[23] and India.[24] In the present study, more than half of the patients (60.0%) were non-smokers, and the majority of smokers quit smoking during this period, which aligned with the results of otherstudies.[25,26]

While most of the patients were treated in the clinical services, those who were older were treated in the ICUs. The previous studies also reported that the majority of the patients were treated in clinics,

TABLE 1 Distribution of the patients' descriptive and medical characteristics (N = 100)

	Intensive care 33 (33.0%)		Clinic 67 (67.0%)		Total 100 (100.0%)	
Characteristics	**Mean ± SD (Min-Max)**		**Mean ± SD (Min-Max)**		**Mean ± SD (Min-Max)**	
Mean hospital stay (d)	4.21 ± 1.59 (2-8)		3.18 ± 1.57 (2-12)		3.52 ± 1.64 (2-12)	
Mean age (y)	53.55 ± 8.91 (37-72)		42.84 ± 12.73 (20-90)		46.39 ± 12.61 (20-90)	
	n	**%**	**n**	**%**	**n**	**%**
Age groups						
18-64 y	28	84.8	63	94.0	91	91.0
65 y and over	5	15.2	4	6.0	9	9.0
Gender						
Women	12	36.4	22	32.8	34	34.0
Men	21	63.6	45	67.2	66	66.0
Educational status						
Illiterate	6	18.2	8	11.9	14	14.0
Primary School	22	66.7	27	40.3	49	49.0
High School	5	15.1	14	20.9	19	19.0
Bachelor's Degree or More	0	0	18	26.9	18	18.0
Financial status						
My income is more than my living expenses	6	18.2	4	6.0	10	10.0
My income enough to cover my living expenses	27	81.8	54	80.6	81	81.0
My income is not enough to cover my living expenses	0	0	9	13.4	9	9.0
Comorbid diseases*						
Diabetes mellitus	18	32.1	5	23.8	23	29.9
Chronic obstructive pulmonary disease	16	28.6	6	28.6	22	28.6
Hypertension	10	17.9	4	19.1	14	18.2
Heart Failure	6	10.7	2	9.5	8	10.4
Renal Failure	2	3.6	2	9.5	4	5.2
Other	4	7.1	2	9.5	6	7.7
Smoking status						
I smoke	14	42.4	20	29.9	34	34.0
I do not smoke	14	42.4	46	68.7	60	60.0
I quit smoking	5	15.2	1	1.4	6	6.0
Communication with the family						
I do not communicate	28	84.8	2	3.0	30	30.0
I communicate over the phone	5	15.2	65	97.0	70	70.0
The way of reaching out to the nurses						
By using the call button	1	3.0	32	47.8	33	33.0
By calling out	32	97.0	35	52.2	67	67.0
Frequency of oxygen therapy						
Continuously	13	39.4	4	6.0	17	17.0
Intermittently	19	57.6	16	23.9	35	35.0
Not Receiving	1	3.0	47	70.1	48	48.0

(Continues)

TABLE 1 (Continued)

Characteristics	Intensive care 33 (33.0%) Mean ± SD (Min-Max)		Clinic 67 (67.0%) Mean ± SD (Min-Max)		Total 100 (100.0%) Mean ± SD (Min-Max)	
Type of the oxygen therapy received						
Nasal Cannula	10	31.2	19	95.0	29	55.8
Simple Mask	4	12.5	1	5.0	5	9.6
Non-invasive CPAP	18	56.3	0	0	18	34.6

Abbreviations: COPD, chronic obstructive pulmonary disease, CPAP, continuous positive airway pressure.

*Options were multipy (participants may have more than one comorbid disease).

and those with more-severe conditions were advanced-age patients who were being treated in ICUs.[22,26]

Han et al (2020)[27] reported that patients with COVID-19 experienced problems such as depression, anxiety and insomnia. Another study reported that sleep quality was low among individuals who isolated themselves during the COVID-19 outbreak.[8] By contrast, a study conducted in Italy reported that the sleep–wake rhythms of patients changed significantly and their sleep quality decreased.[28] The participants of this study stated that the ambient noise in the hospital was not especially disturbing; however, they evaluated their overall sleep quality as poor. This situation may be associated with the fact that factors such as the absence of definitive treatments and a vaccine for COVID-19, uncertainty about the long-term effects of the disease, patients' loss of their usual roles in their families and everyday lives, and loneliness can lead to anxiety and disordered-sleep.[11,29] It was found that patients with less education and those with a comorbid disease experienced poorer sleep quality than those whose education included a bachelor's degree or higher and those without comorbid disease, respectively. Moreover, patients in the clinical services reported better sleep quality than those in the ICU. This outcome was expected because patients with little education tend to know less about COVID-19 and, thereby, have greater levels of fear about the unknown. Those patients with comorbid diseases have more severe symptoms of COVID-19; patients in ICUs are exposed to more medical interventions and stimuli; and their Dyspnea–12 Questionnaire scores are higher because of the severity of their status.[9,29]

The RCSQ mean scores of those who could communicate with their families and reach the nurses using the call button were found to be significantly higher. Nurses, as the healthcare professionals responsible for 24-hour patient care, should inform patients about the use of call buttons in detail, and institutions should provide the necessary regulations to ensure this. Necessary precautions should be taken to improve the social and mental health status of those who are isolated because of infectious diseases and to solve problems that may be encountered in the nursing process. Social service specialists, psychologists and nurses should manage this situation in a multidisciplinary way and encourage patients to communicate with their family members using technology. These approaches are designed to improve mental health and sleep and, thus, can increase resistance to infectious diseases and, by doing so, boost immune function.[8,9,30] It was found that patients receiving continuous and intermittent oxygen therapy, especially those receiving oxygen therapy using non-invasive CPAP, had lower RCSQ scores than those not receiving oxygen supportive therapy. Because non-invasive CPAP therapy must also be used at night and the masks used can cause skin abrasions because of pressure, patient compliance with treatment and impaired comfort may result compared with the nasal cannula and mask applications. Fatigue and dyspnea lead to poor sleep quality and, as a result, negatively affect quality of life.[4,31] This finding was also supported by this study, which revealed a strong correlation between the mean total scores obtained from the RCSQ, the Dyspnea–12 Questionnaire and its sub-questionnaires.

When the Dyspnea–12 Questionnaire mean scores were analyzed, it was found that patients age 65 and older, patients with a comorbid disease, smokers, those who received continuous or intermittent oxygen therapy using non-invasive CPAP masks and those hospitalized in the ICU had higher mean scores. The studies examining the dyspnea severity in patients with COPD reported that their health status worsened and dyspnea severity increased with age.[32-34] Smoking, the most important risk factor for diseases causing lung damage, significantly affects patients' health status, dyspnea severity and quality of life. Several studies reported that the increase in the amount and duration of smoking worsened health status,[35,36] increased dyspnea severity[34] and reduced quality of life[4,32] in patients with COPD. In line with the literature, our study also revealed that patients' health status worsened and dyspnea severity increased in individuals with COVID-19 who smoked. The oxidant substances in cigarette smoke and the abnormal inflammatory process developing in response to oxidant stress are responsible for lung damage in patients.[37] In their systematic review, Wang et al[22] reported that patients with COVID-19 and a comorbid disease had higher acute organ failure and morbidity and experienced a more serious disease process. Therefore, we believe that patients with comorbid disease, those age 65 years

TABLE 2 Comparison of the RCSQ mean scores of the patients with COVID-19 by some of their descriptive and medical characteristics (N = 100)

	Mean ± SD	Test statistics *P*
Unit of hospitalization		
Intensive care	33.21 + 13.10	$t = -7.591$ $P < .001$**
Clinical service	53.43 + 12.23	
Age groups		
18-64 y	47.56 ± 15.88	$t = 1.634$ $P = .056$
65 y and over	38.67 ± 11.48	
Gender		
Women	47.88 ± 18.23	$t = 0.511$ $P = .610$
Men	46.18 ± 14.28	
Educational status		
Illiterate[a]	40.85 ± 16.59	$f = 2.741$ $P = .047$* (a-d)**
Primary school[b]	44.53 ± 17.62	
High school[c]	49.68 ± 9.667	
Bachelor's degree or more[d]	54.33 ± 11.66	
Financial status		
My income is more than my living expenses	56.67 ± 11.53	$f = 2.103$ $P = .128$
My income enough to cover my living expenses	46.02 ± 16.37	
My income is not enough to cover my living expenses	43.80 ± 9.86	
Comorbid diseases		
Yes	41.22 ± 17.34	$t = 3.66$ $P < .001$***
No	52.08 ± 11.85	
Smoking status		
I smoke	43.76 ± 16.93	$X^2 = 3.683$ $P = .159$
I do not smoke	48.70 ± 15.29	
I quit smoking	44.33 ± 10.76	
Communication with the family		
I communicate with my family over the phone	52.03 ± 13.52	$t = -5.949$ $P < .001$***
I do not communicate	34.47 ± 13.53	
The way of reaching out to the nurses		
By using the call button	51.82 ± 9.72	$t = 2.309$ $P = .023$*
By calling out	44.27 ± 17.46	
Frequency of oxygen therapy		
Continuously[a]	35.88 ± 12.35	$f = 33.862$ $P < .001$*** (c-a,b)**
Intermittently[b]	37.77 ± 13.34	
Not receiving[c]	57.17 ± 11.18	
Type of the oxygen therapy received		
Nasal cannula[a]	40.14 ± 12.85	$f = 25.638$ $P < .001$*** (d-a,b,c)**
Simple mask[b]	40.00 ± 7.07	
Non-invasive CPAP[c]	31.56 ± 12.95	
Not receiving[d]	57.17 ± 11.18	

Abbreviations: *t*, independent two-sample *t* test; *f*, single directional variance analysis; X^2, Kruskal–Wallis test.

*Statistical significance at $P < .05$.

**The difference between the groups expressed by the letters is statistically significant at $P < .05$ after Bonferroni correction.

***Statistical significance at $P < .001$.

and older, those who needed oxygen support, and those who received intensive care treatment had more-severe dyspnea since they had more-severe respiratory system-related symptoms of COVID-19.

In this study, a strong negative correlation was found between the total scores obtained from the RCSQ and those obtained from the Dyspnea–12 Questionnaire and its subquestionnaires. This means that patients with COVID-19 who have a high level of dyspnea also suffer from low-quality sleep. Ora et al[38] reported the prevalence of dyspnea as 31.8% in COVID-19 patients, but did not reveal a relationship between dyspnea and neurological symptoms. Jiang et al (2020),[39] on the other hand, evaluated the relationship between mental health status and sleep quality of COVID-19. The study findings reveal that environmental stressors, physical illness, separation from family and friends and other comorbid psychological problems lead to sleep disorders. In this study, Jiang et al[39] found that the presence of comorbid diseases reduces sleep quality. No study in the literature has investigated the relationship between sleep quality and dyspnea associated with the lung damage caused by COVID-19. Budhiraja et al[40] found that 27.3% of 183 participants with COPD had insomnia (a chronic sleep disorder associated with impaired daytime functioning). In diseases involving the respiratory system, the cause of atonia in skeletal muscles, including the accessory muscles of breathing, is not fully known. In this regard, deep desaturation can occur during REM sleep, and mucus plugging and/or hypersecretion may develop during sleep.[41] In addition to these situations, the sleep–wake cycle changes when patients are treated at the hospital. Because of the interventions applied during the hospital stay, individuals may have to be awakened frequently. In the hospital environment, numerous factors including noise, light, nursing interventions, invasive interventions, intermittent or continuous oxygen support, loss of privacy, and being away from one's home may contribute to impaired sleep quality.[19]

TABLE 3 Comparison of the Dyspnea-12 Questionnaire mean scores of the patients with COVID-19 by some of their descriptive and medical characteristics (N = 100)

	Mean ± SD	Test statistics p
Unit of hospitalization		
Intensive care	25.76 ± 9.91	$t = 10.373$ $P < .001$***
Clinical service	5.73 ± 7.08	
Age groups		
18-64 y	11.26 ± 12.05	$t = -2.847$ $P = .005$*
65 y and over	23.22 ± 11.67	
Gender		
Women	12.56 ± 13.16	$t = 0.126$ $P = .900$
Men	12.23 ± 12.15	
Educational status		
Illiterate[a]	18.29 ± 14.00	$f = 6.260$ $P < .001$*** (d-a,b)**
Primary School[b]	15.33 ± 13.16	
High School[c]	8.11 ± 7.61	
Bachelor's Degree or More[d]	4.0.6 ± 1.72	
Financial status		
My income is more than my living expenses	6.67 ± 7.89	$f = 2.858$ $P = .062$
My income enough to cover my living expenses	12.05 ± 12.53	
My income is not enough to cover my living expenses	19.80 ± 12.53	
Comorbid disease		
Yes	19.71 ± 12.69	$t = -7.119$ $P < .001$***
No	5.25 ± 6.88	
Smoking status		
I smoke[a]	15.50 ± 10.67	$X^2 = 10.798$ $P = .005$* (a-b)**
I do not smoke[b]	9.58 ± 12.31	
I quit smoking[c]	22.00 ± 15.95	
Frequency of oxygen therapy		
Continuously[a]	20.06 ± 7.51	$f = 70.912$ $P < .001$*** (c-a, b)**
Intermittently[b]	22.17 ± 11.62	
Not receiving[c]	2.44 ± 3.93	
Type of the oxygen therapy received		
Nasal Cannula[a]	15.69 ± 8.53	$f = 115.074$ $P < .001$*** (d-a, b, c)** (c-a, b)**
Simple mask[b]	18.00 ± 5.09	
Non-invasive CPAP[c]	31.78 ± 5.21	
Not receiving[d]	2.44 ± 3.93	

Abbreviations: *t*, independent two-sample *t* test; *f*, single directional variance analysis; X^2, Kruskal–Wallis test.

*Statistical significance at $P < .05$.

**The difference between the groups expressed by the letters is statistically significant at $P < .05$ after Bonferroni correction.

***Statistical significance at $P < .001$.

4.1 | Limitations

Our study has several limitations. The study was conducted in a single center. To overcome this limitation and increase contributions to the literature, the sample can be diversified by incorporating the intervention studies in hospitals in different regions. In this study, a limited number of factors such as Body Mass Index, drugs affecting sleep, psychosocial factors and patient's position affecting sleep quality and dyspnea were addressed. In addition, in this study Dispnea-12 Questionnaire and RCSQ were applied only one time.

5 | CONCLUSION

In this study, patients with COVID-19 were found to suffer from poor sleep quality, and the more severe patients' dyspnea was, the lower their sleep quality was. Dyspnea and sleep quality are affected by many factors. Diagnosis and treatment of dyspnea are vital to ensure high-quality sleep and, thus, improve the individual's quality of life and health status. Identification and treatment of dyspnea and insomnia contribute positively to the individual's health status by increasing immunity, especially during stressful times such as the COVID-19 pandemic. The results of this study will help nurses, especially those providing treatment and care for patients with COVID-19, to identify factors that affect dyspnea and sleep quality and to plan, implement and evaluate nursing interventions that will reduce their workloads. Furthermore, since long-term effects of COVID-19 on patients are currently unknown, the results of this study are also important for identifying patients' experiences during their hospital stay. Different factors affecting dyspnea and sleep can be investigated, and observational and experimental studies can be conducted in which patients are followed up for longer periods of time.

DISCLOSURES

The authors declare that they have no conflict of interest.

AUTHOR CONTRIBUTIONS

SG, BT, NU, and ID were involved in concept and study design; ID performed data collection; SG, BT, NU perfrmed data analysis and interpretations; SG, BT, and NU were involved in processing the draft of the manuscript; SG, BT, NU, and ID were involved in critical revision of the manuscript; SG, BT, NU, and ID performed article finalization.

ETHICAL APPROVAL

Ethical approval was taken from the Scientific Research Ethical Board in the Faculty of Health Sciences (Date: 27 May 2020, Number: 0028) and permission was granted from Turkish Ministry of Health. The aim of the study and filling procedures of the form were given on the top of the form that was delivered online. There was an option at the beginning of the data collection form that the

TABLE 4 Correlation between Richards-Campbell Sleep Questionnaire and Dyspnea-12 Questionnaire

	Physical Dimension of Dyspnea-12 Questionnaire	Affective Dimension of Dyspnea-12 Questionnaire	Dyspnea-12 Questionnaire Total Score	Richards-Campbell Sleep Questionnaire Total Score
Physical Dimension of Dyspnea-12 Questionnaire	1			
Affective Dimension of Dyspnea-12 Questionnaire	0.986**	1		
Dyspnea-12 Questionnaire Total Score	0.998**	0.995**	1	
Richards-Campbell Sleep Questionnaire Total Score	−0.701**	−0.700**	−0.703**	1

**Statistical significance at $P < .001$, Correlation Coefficient, Spearman Correlation test.

participants had to fill to agree that they understood and volunteered to participate.

DATA AVAILABILITY STATEMENT

Data available on request because of privacy/ethical restrictions.

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