

Poor Sleep Quality and Its Associated Factors among Hospitalized Patients with Chronic Obstructive Pulmonary Disease: A Cross-Sectional Study

Hosein Ghanbarnia

Babol University of Medical Sciences

Reza Mohseni Ahangar

Babol University of Medical Sciences

Arefeh Babazadeh

Babol University of Medical Sciences

Hemmat Gholinia Ahangar

Babol University of Medical Sciences

Sima Ramezaninejad

Babol University of Medical Sciences

Mahjoobeh Betyar

dr.mbetyar@gmail.com

Babol University of Medical Sciences

Research Article

Keywords: Chronic obstructive pulmonary disease, Sleep quality, Pittsburgh Sleep Quality Index, COPD Assessment Test

Posted Date: September 30th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11035685/v1>

License:   This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Sleep issues are prevalent yet frequently overlooked in individuals with chronic obstructive pulmonary disease (COPD) and are associated with worse clinical outcomes. This research assessed sleep quality and related factors in hospitalized patients with COPD.

Methods

This cross-sectional study included 205 patients diagnosed with COPD who were admitted to Babol University of Medical Sciences from December 2023 to February 2024. Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), COPD severity was measured with the COPD Assessment Test (CAT), and anxiety and depression levels were assessed using the Hospital Anxiety and Depression Scale (HADS). Independent t-tests, ANOVA, and multivariable linear regression were used to analyze demographic and clinical data.

Result

A total of 205 patients participated, including 139 males (67.8%) and 66 females (32.2%). All participants had subpar sleep quality based on PSQI criteria. Poor sleep quality was significantly associated with symptoms of anxiety and depression, age, body mass index, the presence and number of comorbidities, cigarette smoking, hookah use, opium use, level of education, occupation, frequency of COPD-related hospitalizations, COPD severity, and symptoms of obstructive sleep apnea (OSA) ($P < 0.05$). Multivariable regression analysis indicated that higher CAT scores, more frequent hospitalizations, and a greater number of comorbidities significantly predicted poorer sleep quality.

Conclusion

Hospitalized patients with COPD exhibited a significant prevalence of poor sleep quality. Severity of disease, presence of multiple illnesses, and frequent hospitalizations were the most significant independent predictors, underscoring the importance of regularly evaluating sleep quality as a component of thorough COPD management.

Introduction

Chronic obstructive pulmonary disease (COPD) ranks among the most prevalent lung disorders and is a major cause of mortality globally, marked by a progressive narrowing of lung air passageways, especially during exhalation, resulting in breathlessness [1]. It is estimated that around 400 million individuals globally are affected by COPD. In 2017, COPD was responsible for over three million fatalities, with an expected rise to 4.5 million deaths by 2040 [2]. Its worldwide prevalence is about 10% among the adult population, rising markedly in older adults, and its occurrence correlates with a heightened risk of other chronic illnesses [3, 4]. In fact, COPD and obstructive sleep apnea (OSA) are quite prevalent. Recent studies based on population data indicate that around 500 million individuals globally are affected by these conditions [5].

People with chronic obstructive pulmonary disease, whose respiratory systems are already not performing at their best, are challenged by the alterations in breathing patterns brought on by sleep [6]. This often leads to sleep disruption due to abnormal breathing patterns (sleep-disordered breathing) and reduced sleep quality (reduced slow-wave and REM2 sleep) [7, 8].

Specifically, sleep disorders are linked to various respiratory conditions, such as COPD. The health effects of sleep disruption and diminished sleep quality in individuals with COPD are significant. In comparison to healthy individuals, those with COPD suffer from increased fatigue and lethargy, elevated depression levels, and a diminished overall quality of life, factors likely affected by sleep disturbances [9–11]. There is a high prevalence of anxiety and depression among COPD patients according to studies, and psychological distress has a profound impact on how people with COPD experience and manage their disease [12]. In patients

with COPD, sleep disruptions can increase the incidence of acute exacerbations by 4.7 times and worsen the illness by 25% to 95% [13, 14]. In order to treat symptoms and reduce the risk of acute exacerbations, it is crucial to evaluate each person's sleep quality. Chabowski M. [15] reported a 61.3% incidence of sleep disturbances in COPD patients, while Budhiraja et al. [9] reported a 37.15% incidence. However, differences between domestic and international data indicate multiple influences on sleep quality.

Although there is growing awareness of sleep issues in COPD, numerous patients are not regularly assessed for sleep difficulties in clinical settings. Recognizing potentially alterable factors linked to reduced sleep quality could enhance symptom management and overall disease treatment.

This study was performed to evaluate the quality of sleep in hospitalized COPD patients and examine its relationship with demographic factors, disease severity, comorbidities, psychological symptoms, smoking-related aspects, and features related to OSA.

Materials and Methods

Study Design and Participants

This cross-sectional research was conducted on patients with COPD who were admitted to departments associated with Babol University of Medical Sciences between December 2023 and February 2024. Patients aged 18 to 70 years with a verified diagnosis of COPD were considered for inclusion. Patients who had incomplete questionnaires or conditions that hindered accurate completion of the assessment tools were excluded.

Inclusion Criteria

1. Adult patients aged 18–70 years with confirmed COPD diagnosis
2. Willingness to participate in the study.

Exclusion Criteria

1. Patients with comorbid pulmonary disease (lung cancer, interstitial lung disease or pneumonia)
2. Patients with established psychiatric illnesses (psychosis, cognitive impairment, dementia, panic disorders, etc.)
3. Patients with active malignancy.
4. History of sleep disorder before diagnosis COPD.
5. Users of sleeping medications and other drugs that affect the patient's sleep.

Sample Size

Patients in the Babol teaching hospitals who have been diagnosed with COPD. The procedure for determining a population mean was used to calculate the required minimum sample size. A 95% confidence level ($Z = 1.96$), a standard deviation (S) of 0.73 from a previous study, and a margin of error (d) of 0.10 were used [16]. Thus, the estimated minimum sample size needed was found to be 205 participants. Eligible patients were consecutively recruited until the desired sample size was met.

Data Collection

Demographic and clinical information, such as age, gender, education level, employment status, marital status, smoking habits, hookah consumption, opioid use, family history of COPD, body mass index (BMI), existing medical conditions, and past hospitalizations due to COPD, was gathered through a standardized questionnaire. The PSQI assessed the patients' sleep quality, while the CAT scale evaluated the severity of their COPD symptoms. The HADS was utilized to evaluate anxiety and depression factors to identify the elements influencing patients' sleep.

Assessment Tools

Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index was used to assess sleep quality; this validated tool includes seven factors that evaluate subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction. The scores achieved on each subscale will finally be classified from zero to three, ranging from almost no sleep issues to severe issues. The overall score will be determined by adding the scores of the seven subscales, which will total between zero and 21. Higher scores reflect worse sleep quality, and a total score over five on the complete questionnaire signifies poor sleep quality. In the Iranian version of this questionnaire, validity was 0.86 and reliability was 0.89 [56], indicating that this scale has the necessary validity for use in the Iranian population.

COPD Assessment Test (CAT)

The COPD Assessment Test was used to evaluate disease impact and symptom severity. Higher CAT scores indicate greater disease burden. In this study, a CAT score ≥ 10 indicates poor symptom control.

Hospital Anxiety and Depression Scale (HADS)

Psychological symptoms were evaluated with HADS, featuring distinct subscales for symptoms of anxiety and depression. The anxiety and depression subscales in the survey have Cronbach's alpha values of 0.85 and 0.7, respectively, making them suitable for the Iranian population [17].

Statistical Analysis

Data were examined using version 21 of the Statistical Package for the Social Sciences (SPSS) software (IBM Corp., Armonk, NY, USA).

Descriptive statistics were reported as mean $\pm$ standard deviation (SD) for continuous variables and as frequency (percentage) for categorical variables. The independent t-test and one-way ANOVA were utilized to compare average knowledge scores among the groups. The chi-square test was utilized to evaluate connections between categorical variables. A p-value of less than 0.05 was deemed statistically significant.

Ethical Considerations

The study protocol was approved by the Ethics Committee of Babol University of Medical Sciences (Ethics Code: IR.MUBABOL.REC.1402.193). Participation in the study was voluntary, and informed consent was obtained from all participants prior to enrollment. Participants' anonymity and confidentiality were strictly maintained throughout the study.

Results

Demographic characteristics

A total of 205 patients with COPD were examined. Among them, 139 (67.8%) were male and 66 (32.2%) were female. 47.8% of patients were 60 years of age or older. Also, 118 people (57.6%) of them reported smoking. A greater number of patients (59.5%) had fewer than 3 days of hospitalization, and 62.4% of patients had no symptoms of sleep apnea symptoms (Table 1).

Sleep Quality and Demographic Characteristics

A significant association was observed between age and sleep quality ($P < 0.001$), with older participants reporting poorer sleep quality. Sleep quality also differed significantly according to occupational status ($P < 0.001$), with unemployed individuals and those with self-employment demonstrating poorer sleep quality than employees. Educational level was significantly associated with sleep quality ($P < 0.001$), as participants with lower educational attainment (illiterate or primary education) had poorer sleep quality compared with those holding a diploma or higher educational qualifications. Furthermore, participants who reported cigarette smoking ($P < 0.001$), hookah smoking ($P = 0.011$), or opium use ($P < 0.001$) had significantly poorer sleep quality than non-users. In contrast, no significant associations were found between sleep quality and sex ($P = 0.073$), marital status ($P = 0.245$), or alcohol consumption ($P = 0.280$).

Table 3 presents the association between sleep quality and disease-related characteristics. Sleep quality was significantly poorer among patients with a history of ≥ 3 hospitalizations compared with those with fewer than three hospitalizations ($P < 0.001$). Patients with obstructive sleep apnea also had significantly higher sleep quality scores, indicating poorer sleep quality, than those without obstructive sleep apnea ($P < 0.001$). BMI was significantly associated with sleep quality ($P = 0.034$), with obese patients exhibiting the poorest sleep quality. However, no significant association was observed between family history of COPD and sleep quality ($P = 0.188$). In addition, sleep quality deteriorated significantly with increasing number of comorbidities ($P < 0.05$).

Association between Psychological Symptoms and Sleep Quality

According to Table 4, in comparing the sleep quality of patients based on the severity of COPD assessed by the CAT criterion, there is a significant association between the severity of COPD and the quality of sleep of patients ($p < 0.001$). Based on the HADS criteria for anxiety and depression symptoms, a score of ≥ 7 in each subscale signifies the existence of symptoms, with 95 (46.3%) patients indicating anxiety symptoms and 107 (52.2%) indicating depressive symptoms. In analyzing sleep quality according to the HADS criteria, the relationship between sleep quality and symptoms of anxiety and depression was investigated, revealing a significant correlation ($p < 0.001$) between the occurrence of anxiety and depression symptoms in patients and their sleep quality; furthermore, the existence of any anxiety or depression symptoms was linked to compromised sleep quality in those individuals.

Multivariable Regression Analysis

A multivariable stepwise linear regression analysis was performed to identify independent predictors of sleep quality in Table 5. All variables that were significant in the univariate analyses were entered into the regression model. The final model explained 26.2% of the variance in sleep quality ($R^2 = 0.262$). COPD symptom severity, measured by the COPD Assessment Test (CAT), was the strongest independent predictor of poorer sleep quality ($\beta = 0.41$, $B = 0.16$, 95% CI: 0.11–0.22, $P < 0.001$). In addition, the number of hospitalizations remained a significant independent predictor ($\beta = 0.24$, $B = 1.18$, 95% CI: 0.50–1.87, $P = 0.001$). The number of comorbidities was also independently associated with poorer sleep quality ($\beta = 0.13$, $B = 0.68$, 95% CI: 0.00–1.36, $P = 0.049$).

According to Table 6, in examining the effect of components on the significant association of sleep quality with the mentioned variables, in relation to the age variable, all components had a significant effect on the occurrence of this association ($p < 0.05$); in such a way that with increasing age, each of the mentioned components including subjective quality of sleep, delay in falling asleep, sleep duration, sleep efficiency, sleep disorder, use of sleeping medications and daily functional disorders obtained a higher score in the PSQI questionnaire, which in total led to a worsening of the patients' sleep quality. In examining the variables of opium consumption, number of hospitalizations, number of comorbidities, CAT score and anxiety symptoms, all components also had a significant effect on the occurrence of this association. In examining the occupation variable, components one, two, six and seven also had a significant effect. In the case of education level, components one, two, five, six and seven also had a significant effect on the occurrence of this association. Also, in examining cigarette consumption, components one, two, three, six and seven, and in the case of hookah consumption, component Components one, three, six and seven had a significant effect. In examining the BMI variable, components one, four, five and seven had a significant effect.

In examining the obstructive sleep apnea incidence variable, only component five, which indicated the occurrence of sleep disorders, had no significant effect. In addition, in examining depressive symptoms, only components three and four, which indicate the duration of sleep and the level of sleep efficiency, had no significant effect on the occurrence of this association.

Table 1
, Demographic and Clinical Characteristics of the Study Population

Variable	Category	n (%)
Age (years)	< 45	41 (20.0)
	45–59	66 (32.2)
	≥ 60	98 (47.8)
Sex	Male	139 (67.8)
	Female	66 (32.2)
Marital status	Married	201 (98.0)
	Single	4 (2.0)
Occupation	Employee	27 (13.2)
	Self-employed	77 (37.6)
	Unemployed	101 (49.3)
Education	Illiterate	48 (23.4)
	Below diploma	71 (34.6)
	Diploma/Associate degree	54 (26.3)
	Bachelor's degree or higher	32 (15.6)
Current smoking	Yes	118 (57.6)
	No	87 (42.4)
Alcohol consumption	Yes	14 (6.8)
	No	191 (93.2)
Hookah use	Yes	40 (19.5)
	No	165 (80.5)
Opium use	Yes	70 (34.1)
	No	135 (65.9)
Previous COPD hospitalizations	< 3 admissions	122 (59.5)
	≥ 3 admissions	83 (40.5)
Family history of COPD	Yes	29 (14.1)
	No	176 (85.9)
Sleep apnea symptoms	Yes	77 (37.6)
	No	128 (62.4)
COPD: Chronic Obstructive Pulmonary Disease		

Table 2
, Association between sleep quality and participants' demographic characteristics

Variable	Category	n	PSQI (Mean $\pm$ SD)	P-value
Age (years)	45–59	66	12.05 $\pm$ 2.27	0.001
	≥ 60	98	13.48 $\pm$ 2.00	
Sex	Female	66	12.47 $\pm$ 2.45	0.073
	Male	139	12.35 $\pm$ 2.38	
Marital status	Single	4	11.00 $\pm$ 2.70	0.245
	Married	201	12.41 $\pm$ 2.39	
Occupation	Employee	27	10.81 $\pm$ 2.00	< 0.001
	Self-employed	77	12.35 $\pm$ 2.30	
	Unemployed	101	12.91 $\pm$ 2.40	
Education	Illiterate	48	13.63 $\pm$ 2.14	< 0.001
	Primary school	71	12.82 $\pm$ 2.12	
	Diploma	54	11.57 $\pm$ 2.35	
	Academic degree	33	10.94 $\pm$ 2.31	
Cigarette smoking	No	87	11.46 $\pm$ 2.55	< 0.001
	Yes	118	13.07 $\pm$ 2.04	
Alcohol consumption	No	191	12.43 $\pm$ 2.41	0.280
	Yes	14	11.71 $\pm$ 2.33	
Hookah smoking	No	165	12.18 $\pm$ 2.44	0.011
	Yes	40	13.25 $\pm$ 2.04	
Opium use	No	135	11.53 $\pm$ 2.28	< 0.001
	Yes	70	14.04 $\pm$ 1.65	

Table 3
, Comparing sleep quality based on other factors related to disease and individuals' history

Variable	Category	n	PSQI (Mean ± SD)	P-value
Hospitalizations	< 3	122	11.27 ± 2.22	< 0.001
	≥ 3	83	14.02 ± 1.58	
Family history of COPD	Positive	29	12.93 ± 2.08	0.188
	Negative	176	12.30 ± 2.44	
BMI (kg/m²)	< 18.5	5	12.20 ± 2.68	0.034
	18.5–24.9	64	11.86 ± 2.49	
	25.0–29.9	122	12.50 ± 2.35	
	≥ 30	14	13.86 ± 2.14	
Obstructive sleep apnea	Yes	77	13.94 ± 1.45	< 0.001
	No	128	11.45 ± 2.38	
Number of comorbidities	< 3	130	11.45 ± 2.21	< 0.001
	≥ 3	75	14 ± 1.79	
PSQI: Pittsburgh Sleep Quality Index, BMI: Body mass index				

Table 4
, Comparison of sleep quality based on CAT and HADS

Variable	Category		n	PSQI (Mean ± SD)	P-value
CAT	10–20		49	10.16 ± 1.49	< 0.001
	20–30		98	12.58 ± 2.20	
	30–40		58	13.93 ± 1.95	
HADS	Anxiety	Yes	95	13.53 ± 1.97	< 0.001
		No	110	11.40 ± 2.31	
	Depression	Yes	107	13.20 ± 2.11	< 0.001
		No	98	11.50 ± 2.39	
CAT: COPD Assessment Test, PSQI: Pittsburgh Sleep Quality Index, HADS: Hospital Anxiety and Depression Scale					

Table 5
, Multivariable linear regression analysis for predictors of sleep quality

Predictor	B	SE	Standardized β	t	95% CI for B	P-value
Constant	7.27	0.63	–	11.49	6.02–8.51	< 0.001
CAT score	0.16	0.02	0.41	6.31	0.11–0.22	< 0.001
Number of hospitalizations	1.18	0.34	0.24	3.41	0.50–1.87	0.001
Number of comorbidities	0.68	0.34	0.13	1.97	0.00–1.36	0.049

Model statistics: $R^2 = 0.262$, B: unstandardized regression coefficient; SE: standard error; β : standardized regression coefficient; CI: confidence interval; CAT: COPD Assessment Test.

Table 6
Association between demographic and clinical variables and Pittsburgh Sleep Quality Index (PSQI) component score

Variable	Component 1 (Subjective sleep quality)	Component 2 (Sleep latency)	Component 3 (Sleep duration)	Component 4 (Habitual sleep efficiency)	Component 5 (Sleep disturbances)	Component 6 (Use of sleep medication)	Component 7 (Daytime dysfunction)
Age	< 0.001	< 0.001	0.013	< 0.001	0.045	< 0.001	< 0.001
Occupation	< 0.001	0.003	0.956	0.175	0.449	0.008	0.016
Education	< 0.001	< 0.001	0.477	0.120	0.004	0.018	< 0.001
Cigarette smoking	< 0.001	0.001	0.014	0.209	0.292	< 0.001	< 0.001
Hookah smoking	0.003	0.566	0.057	0.330	0.875	0.014	0.001
Opium use	< 0.001	< 0.001	0.084	< 0.001	0.003	< 0.001	< 0.001
Number of hospitalizations	< 0.001	< 0.001	0.003	< 0.001	0.035	< 0.001	< 0.001
BMI	0.052	0.242	0.463	0.061	0.072	0.146	0.006
OSA	< 0.001	< 0.001	0.061	< 0.001	0.443	< 0.001	< 0.001
Number of comorbidities	< 0.001	< 0.001	0.037	< 0.001	0.001	0.002	< 0.001
CAT score	< 0.001	< 0.001	0.001	0.002	0.010	< 0.001	< 0.001
Anxiety symptoms (HADS)	< 0.001	< 0.001	0.038	0.006	0.016	< 0.001	< 0.001
Depressive symptoms (HADS)	< 0.001	< 0.001	0.389	0.103	0.048	0.006	< 0.001
BMI: Body Mass Index, PSQI: Pittsburgh Sleep Quality Index; CAT: COPD Assessment Test; HADS: Hospital Anxiety and Depression Scale; BMI: body mass index; OSA: obstructive sleep apnea							

Discussion

The present study aimed to investigate sleep quality and its related factors in patients with COPD hospitalized in hospitals affiliated with Babol University of Medical Sciences. The results of this research indicated that every patient examined experienced inadequate sleep quality, with PSQI scores exceeding 5 for all subjects. This underscores the significant prevalence of sleep disorders among these patients and emphasizes the need to consider sleep in the clinical evaluation of COPD individuals.

The results of the present study were consistent with the studies of Bo Ding et al.[18], DM Nunes et al.[19], Buket Akinci et al.[20], and DCS Clímaco et al.[21], while they were inconsistent with the reports of Alyanisa Ulfathinah et al.[22], Chih-Hao Chang et al. [23], María Sáez-López et al.[24], Eslaminejad et al. [25], J-Geiger Brown et al. [26], and LI Xingyang et al.[27]. These inconsistencies may stem from variations in the study population's traits, disease severity, assessment methods, hospitalization circumstances, along with cultural and racial disparities.

The current study's findings revealed a significant relationship between anxiety symptoms, measured by the HADS scale, and sleep quality in patients with COPD. This result aligned with the research conducted by María Sáez-López et al. [24], Eslaminejad

et al. [25], LI Xingyang et al.[27], and Aditi Shah et al. [28], but did not match the findings of Bo Ding et al. [18], Chih-Hao Chang et al.[23], Yousef Saad Aldabayan [29] and CD Naele [7]. These differences were probably due to heterogeneity in anxiety severity, differences in psychological support, hospitalization status of patients, and differences in sample size. From a clinical perspective, anxiety can reduce sleep quality by increasing psychological arousal, exacerbating perceived shortness of breath, and disrupting sleep initiation and continuation.

Also, in this study, a significant relationship was observed between depressive symptoms and sleep quality. This result was consistent with the studies of María Sáez-López et al. [24](37), Eslaminejad et al. [25], LI Xingyang et al. [27], and Aditi Shah et al. [28], and in contrast to the findings of Chih-Hao Chang et al.[23], Yousef Saad Aldabayan and CD Naele [29, 30]. Depression may contribute to poor sleep quality in COPD patients by reducing motivation, disrupting circadian rhythms, reducing daily activity, and increasing fatigue. Therefore, regular screening for depressive symptoms in these patients can be effective in identifying individuals at risk and designing appropriate interventions.

In this study, sleep quality also decreased with increasing BMI, although this finding was not consistent with any of the reviewed studies [20, 22–24]. This difference may be due to the high proportion of overweight individuals in the present study sample, with 59.5% of patients in the BMI range of 25 to 30. Excess weight can impair sleep quality by increasing mechanical load on the respiratory system, exacerbating dyspnea, and increasing the likelihood of sleep-related breathing disorders. However, studies with larger samples and more precise BMI classification are necessary to clarify this association.

In the study of smoking, it was found that there was a significant association between smoking and poor sleep quality. This result was consistent with the study by María Sáez -López et al. [24], but not with the studies by Bo Ding [18], Alyanisa Ulfatinah, and Buket Akinci [20, 22]. Given the high prevalence of smoking in the present study sample, this finding could indicate a cumulative effect of tobacco use on worsening nocturnal respiratory symptoms and reducing sleep quality. Smoking may also indirectly disrupt sleep by increasing airway inflammation and worsening respiratory status.

COPD severity was also significantly associated with sleep quality. This finding was consistent with the studies of Bo Ding et al. [18], Chih-Hao Chang [23], María Sáez-López [24], DCS Clímaco [21], Nikolaos Koulouris [31], and Despo Lerodiakonou [32], but differed from the results of J-Geiger Brown and Sajal De [26, 33]. More severe COPD is usually associated with more severe dyspnea, nocturnal cough, frequent awakenings, and decreased oxygen saturation, and can seriously disrupt nocturnal sleep. In the present study, this association was observed more clearly, probably due to the higher range of CAT scores.

There was also a significant association between the occurrence of obstructive sleep apnea and the quality of sleep of the patients. This result was consistent with the studies of Buket Akinci [20], Aditi Shah [28], and Mohammad Ali Zahal et al. [34] and was only inconsistent with the study of DCS Clímaco [21]. The overlap of COPD and OSA can lead to increased nocturnal hypoxemia, fragmented sleep, and a significant decrease in sleep quality. Early identification of this overlap is of particular clinical importance, as it can influence therapeutic decision-making and prevent complications.

This study has some limitations. First, its cross-sectional design precludes the establishment of causal relationships between the variables of interest. Second, the diagnosis of certain comorbid conditions and the assessment of social habits were based on participants' self-reports. Finally, the study sample consisted exclusively of hospitalized patients recruited from hospitals within a single town. Therefore, the findings may not be generalizable to the broader population of patients with chronic obstructive pulmonary disease (COPD) across the country.

Conclusion

In this study, sleep quality was inadequate among all hospitalized COPD patients and showed significant associations with various factors, including symptoms of anxiety and depression, age, BMI, comorbidities, smoking status, education level, occupation, COPD severity, hospitalization frequency, and occurrence of OSA. In the multivariate linear regression model, the CAT score, hospitalizations, and comorbidities were independent predictors of sleep quality. These results suggest that sleep quality in COPD patients is influenced by multiple factors and should be assessed concurrently with respiratory symptoms, mental health, and other health conditions.

Declarations

Ethics approval and consent to participate

The Ethics Committee of Babol University of Medical Sciences approved the study (Ethics Code: IR.MUBABOL.REC.1402.193). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and the 1964 Declaration of Helsinki and its subsequent amendments or comparable ethical standards.

Consent for publication

Not applicable.

Availability of data and material

The datasets generated and analyzed during the current study are not publicly available because they contain confidential participant information and institutional restrictions. De-identified data are available from the corresponding author upon reasonable request and with permission from Babol University of Medical Sciences

Competing interests

The authors declare no competing interests.

Funding

No funding was received.

Authors' contributions

Every author contributed to the design of the study. RMA, MB, and AB handled the study design, analysis of data, and the formulation of the intellectual content. HG played a role in the study design, literature review, and data collection. HGA assisted with the analysis of data. SR aided in the preparation of the manuscript. All authors examined and revised the manuscript and gave their approval for the final version.

Acknowledgments

This study was conducted as part of an approved research project at Babol University of Medical Sciences. The authors are grateful for the support of the Vice Chancellor for Research and Technology of Babol University of Medical Sciences.

References

1. Decramer M, Janssens W, Miravittles M (2012) Chronic obstructive pulmonary disease. *Lancet* 379(9823):1341–1351. 10.1016/s0140-6736(11)60968-9
2. D'Cruz RF, Murphy PB, Kaltsakas G (2020) Sleep disordered breathing and chronic obstructive pulmonary disease: a narrative review on classification, pathophysiology and clinical outcomes. *J Thorac Dis* 12(Suppl 2):S202–s16. 10.21037/jtd-cus-2020-006
3. Celli BR, Wedzicha JA (2019) Update on Clinical Aspects of Chronic Obstructive Pulmonary Disease. *N Engl J Med* 381(13):1257–1266. 10.1056/NEJMra1900500
4. Agustí A, Hogg JC (2019) Update on the Pathogenesis of Chronic Obstructive Pulmonary Disease. *N Engl J Med* 381(13):1248–1256. 10.1056/NEJMra1900475
5. Benjafield AV, Ayas NT, Eastwood PR, Heinzer R, Ip MSM, Morrell MJ, Nunez CM, Patel SR, Penzel T, Pépin JL, Peppard PE, Sinha S, Tufik S, Valentine K, Malhotra A (2019) Estimation of the global prevalence and burden of obstructive sleep apnoea: a literature-based analysis. *Lancet Respir Med* 7(8):687–698. 10.1016/s2213-2600(19)30198-5

6. Zamarrón C, García Paz V, Morete E, F del Campo Matías (2008) Association of chronic obstructive pulmonary disease and obstructive sleep apnea consequences. *Int J Chron Obstruct Pulmon Dis* 3(4):671–682. 10.2147/copd.s4950
7. McNicholas WT, Verbraecken J, Marin JM (2013) Sleep disorders in COPD: the forgotten dimension. *Eur Respir Rev* 22(129):365–375. 10.1183/09059180.00003213
8. Cormick W, Olson LG, Hensley MJ, Saunders NA (1986) Nocturnal hypoxaemia and quality of sleep in patients with chronic obstructive lung disease. *Thorax* 41(11):846–854. 10.1136/thx.41.11.846
9. Budhiraja R, Siddiqi TA, Quan SF (2015) Sleep disorders in chronic obstructive pulmonary disease: etiology, impact, and management. *J Clin Sleep Med* 11(3):259–270. 10.5664/jcsm.4540
10. Breslin E, van der Schans C, Breukink S, Meek P, Mercer K, Volz W, Louie S (1998) Perception of fatigue and quality of life in patients with COPD. *Chest* 114(4):958–964. 10.1378/chest.114.4.958
11. Agusti A, Hedner J, Marin JM, Barbé F, Cazzola M, Rennard S (2011) Night-time symptoms: a forgotten dimension of COPD. *Eur Respir Rev* 20(121):183–194. 10.1183/09059180.00004311
12. Hynninen KM, Breivte MH, Wiborg AB, Pallesen S, Nordhus IH (2005) Psychological characteristics of patients with chronic obstructive pulmonary disease: a review. *J Psychosom Res* 59(6):429–443. 10.1016/j.jpsychores.2005.04.007
13. Baugh A, Buhr RG, Quibrera P, Barjaktarevic I, Barr RG, Bowler R, Han MK, Kaufman JD, Koch AL, Krishnan J, Labaki W, Martinez FJ, Mkorombindo T, Namen A, Ortega V, Paine R, Peters SP, Schotland H, Sundar K, Zeidler MR, Hansel NN (2022) PG Woodruff, and N Thakur. Risk of COPD exacerbation is increased by poor sleep quality and modified by social adversity. *Sleep* 45(8). 10.1093/sleep/zsac107
14. Omachi TA, Blanc PD, Claman DM, Chen H, Yelin EH, Julian L, Katz PP (2012) Disturbed sleep among COPD patients is longitudinally associated with mortality and adverse COPD outcomes. *Sleep Med* 13(5):476–483. 10.1016/j.sleep.2011.12.007
15. Chabowski M, Łuczak J, Dudek K, Jankowska-Polańska B (2019) Sleep Disorders and Adherence to Inhalation Therapy in Patients with Chronic Obstructive Pulmonary Disease. *Adv Exp Med Biol* 1160:43–52. 10.1007/5584_2019_345
16. Milic-Emili J (2004) Does mechanical injury of the peripheral airways play a role in the genesis of COPD in smokers? *COPD. J Chronic Obstr Pulmonary Disease* 1(1):85–92
17. H K, S H, S V, and E N. Reliability and validity of Anxiety and Depression Hospital Scales (HADS): Iranian patients with anxiety and depression disorders. *Tehran Univ Med J.* (2009) ;67(5):379–385. doi
18. Ding B, Small M, Bergström G, Holmgren U (2017) A cross-sectional survey of night-time symptoms and impact of sleep disturbance on symptoms and health status in patients with COPD. *Int J Chronic Obstr Pulm Dis.* :589–599. doi
19. Nunes DM, Mota RMS, de Pontes Neto OL, Pereira EDB, de Bruin VMS, de Bruin PFC (2009) Impaired sleep reduces quality of life in chronic obstructive pulmonary disease. *Lung* 187(3):159–163
20. Akinci B, Aslan GK, Kiyani E (2018) Sleep quality and quality of life in patients with moderate to very severe chronic obstructive pulmonary disease. *Clin Respir J* 12(4):1739–1746
21. Clímaco DCS, Lustosa TC, Silva MVFP, Lins-Filho OL, Rodrigues VK, Oliveira-Neto LAP, Feitosa ADM, Queiroga FJP Jr, Cabral MM, Pedrosa RP (2022) Sleep quality in COPD patients: correlation with disease severity and health status. *Jornal Brasileiro de Pneumologia* 48(03):e20210340
22. Ulfathinah A, Rachmi SF, Indracahyani A (2019) Characteristics affecting sleep quality of COPD patients. *Enfermería Clínica* 29:30–35
23. Chang C-H, Chuang L-P, Lin S-W, Lee C-S, Tsai Y-H, Wei Y-F, Cheng S-L, Hsu J-Y, Kuo P-H, Yu C-J (2016) Factors responsible for poor sleep quality in patients with chronic obstructive pulmonary disease. *BMC Pulm Med* 16(1):118
24. Sampol J, Miravittles M, Sáez M, Pallero M, Sampol G, Ferrer J (2023) Poor sleep quality, COPD severity and survival according to CASIS and Pittsburgh questionnaires. *Sci Rep* 13(1):18656
25. Eslaminejad A, Safa M, Ghassem Boroujerdi F, Hajizadeh F, Pashm Froush M (2017) Relationship between sleep quality and mental health according to demographics of 850 patients with chronic obstructive pulmonary disease. *J Health Psychol* 22(12):1603–1613

26. Geiger-Brown J, Lindberg S, Krachman S, McEvoy CE, Criner GJ, Connett JE, Albert RK, Scharf SM (2015) Self-reported sleep quality and acute exacerbations of chronic obstructive pulmonary disease. *Int J Chronic Obstr Pulm Dis*. :389–397. doi
27. LI X, W SUN, M YIN (2024) Sleep Quality and Anxiety and Depression in Patients with Chronic Obstructive Pulmonary Disease and Their Influencing Factors: a Multicenter Cross-sectional Study. *Chin Gen Pract* 27(20):2437
28. Shah A, Ayas N, Tan W-C, Malhotra A, Kimoff J, Kaminska M, Aaron SD, Jen R (2020) Sleep quality and nocturnal symptoms in a community-based COPD cohort. *COPD: J Chronic Obstr Pulmonary Disease* 17(1):40–48
29. Aldabayan YS (2023) Mental health and sleep quality among patients with asthma and COPD. *Front Med* 10:1181742
30. Neale CD, Christensen PE, Dall C, Ulrik CS, Godtfredsen N, Hansen H (2022) Sleep Quality and Self-Reported Symptoms of Anxiety and Depression Are Associated with Physical Activity in Patients with Severe COPD. *Int J Environ Res Public Health* 19(24). 10.3390/ijerph192416804
31. Koulouris N, Dimakou K, Gourgoulisanis K, Tzanakis N, Rapti A, Gaga M, Georgatou N, Steiropoulos P, Karachristos C, Gogali A (2022) Self-perceived quality of sleep among COPD patients in Greece: the SLEPICO study. *Sci Rep* 12(1):540
32. Ierodiakonou D, Bouloukaki I, Kampouraki M, Papadokostakis P, Poulorinakis I, Lampraki I, Athanasiou P, Schiza S, Tsiligianni I (2020) Subjective sleep quality is associated with disease status in COPD patients. The cross-sectional Greek UNLOCK study. *Sleep Breath* 24(4):1599–1605
33. De S (2012) Subjective assessment of quality of sleep in chronic obstructive pulmonary disease patient and its relationship with associated depression. *Lung India* 29(4):332–335
34. Zohal MA, Yazdi Z, Kazemifar AM, Mahjoob P, Ziaeeha M (2014) Sleep Quality and Quality of Life in COPD Patients with and without Suspected Obstructive Sleep Apnea. *Sleep Disord* 2014:508372. 10.1155/2014/508372