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ORIGINAL RESEARCH

The Role of Depression in Linking Sleep Quality and Life Quality in OSAHS Patients

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Purpose: OSAHS patients' quality of life is significantly impacted by poor sleep. This study examines the mediating role of depression in the relationship between sleep quality and life quality among OSAHS patients.

Patients and Methods: Convenience sampling was applied to gather participants at a Chongqing tertiary hospital. Participants filled out questionnaires measuring their quality of life, depression, and sleep quality. Sleep quality was gauged by the Pittsburgh Sleep Quality Index (PSQI), depression was assessed by the Patient Health Questionnaire (PHQ-9), and quality of life was assessed by the Quebec Sleep Questionnaire (QSQ). Mediation analysis was performed via SPSS PROCESS.

Results: The study found that depressive symptoms ($r=-0.705$, $p<0.01$) and sleep quality ($r=-0.578$, $p<0.01$) were adversely associated with quality of life in OSAHS patients. Depressive symptoms were found to significantly mediate the relationship between sleep quality and quality of life in OSAHS patients (Bootstrap 95% CI −0.0992, −0.0483), with 49.55% of the effect size attributable to the pathway from sleep quality to depression to quality of life.

Conclusion: Sleep quality and depressive symptoms are important indicators of quality of life in OSAHS patients. Depression serves as a partial mediator (In this study, the mediating factor refers to the element that controls the association between quality of life and sleep quality) in the relationship between sleep quality and quality of life. Interventions aimed at enhancing sleep quality and alleviating depressive symptoms may lead to an improved quality of life for OSAHS patients.

Keywords: OSAHS, depression, sleep quality, quality of life, mediator

Introduction

Obstructive sleep apnea-hypopnea syndrome (OSAHS) is a widespread chronic condition characterized by sleep fragmentation at its core, in which the patient's upper airway partially or completely collapses as you sleep, resulting in recurrent hypoventilation (partial cessation of breathing) or respiratory apnea (complete respiratory arrest).[1] The prevalence ranges from 9% to 38% globally.[2] With 176 million patients, China has the most OSAHS sufferers worldwide.[3] Because of its strong correlation with metabolic problems,[4] cardiovascular diseases,[5–7] and neurocognitive impairment,[8,9] it has become a significant public health concern.

Excessive daytime sleepiness and impaired cognitive, social, and physical function are common in people with OSAHS. They deal with low job performance, despair, and rising divorce rates. In general, their quality of life is adversely impacted.[10,11] The five domains of quality of life (QOL)—physical, psychological, social, environmental, and functional—are used to evaluate a person's overall well-being and level of life satisfaction. "A person's perception of his or her position in life in the context of his or her culture and value system, as well as about goals, expectations, standards, and concerns" is how the World Health Organization (WHO) defines the quality of life.[12] It is a crucial component in evaluating the health of patients and is used as a gauge of therapy results. Research has indicated that a person's pursuit of a better quality of life is significantly influenced by the quality of their sleep. Impaired quality of life is linked to poor sleep quality,[13] and improving sleep health may lessen overall disparities in quality of life.[14] Nonetheless, OSAHS

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patients frequently have poor sleep, which impairs functioning, cognition, safety, mood, and interpersonal connections,[15] resulting in a reduced standard of living and a greater social cost.[16,17] Additionally, prior study has demonstrated that the average severity of symptoms associated to poor sleep quality in OSAHS patients exceeds the typical critical threshold.[18] Additionally, people with OSAHS are more likely to experience nightmares.[19] Patients' sleep quality is significantly impacted by both symptoms of daytime sleepiness and sleep deprivation.[20,21]

According to the WHOQOL model proposed by the WHO, physical and mental states both influence quality of life.[22] In OSAHS patients, depression may also impact their quality of life and sleep. Epidemiologic findings indicate that 35% of OSAHS patients have experienced general depressive symptoms,[23] and it is known that OSAHS is associated with the onset of depression.[24,25] Compared to the normal population, patients with OSAHS experience higher depressive symptoms, and poor sleep quality is associated to depressive status.[26] The risk of depression is increased by OSAHS, which is caused by sleep loss and alterations in sleep structure, And depression can be treated by controlling sleep quality.[21,27] On the other hand, it is unknown how exactly depression modifies OSAHS patients' quality of life. As a consequence, more investigation is required to examine the association between the three.

Given the foregoing, the intention of this study was to investigate OSAHS patients' quality of life, sleep, and current depressive status. To examine how depression influences OSAHS patients' sleep and overall quality of life and to provide guidance for enhancing these OSAHS patients' quality of life. We hypothesized that: (1) Mental health and quality of life are positively impacted by good sleep, and (2) Depression mediates the relationship between OSAHS patients' quality of life and sleep quality.

Materials and Methods

Study Design and Participants

The cross-sectional survey was performed using convenience sampling. To recruit study participants, posters were displayed in the inpatient wards, outpatient clinics, and sleep monitoring rooms of the Department of Otolaryngology, Head and Neck Surgery of a tertiary hospital in Chongqing between December 2023 and August 2024. Eligible patients were referred by the Department of Otolaryngology, Head and Neck Surgery's sleep monitors, and the doctors who worked in the outpatient clinics. In the end, 220 OSAHS patients were enlisted as research participants. Before each patient completed the questionnaire, the patients' consent was sought, and the physician reviewed the patients' medical record and auxiliary examination data and asked about past and present medical history. The patients and their families were also asked to confirm the recent use of antidepressants to ensure that the included study subjects had not taken antidepressants recently. The following were the requirements for inclusion: (1) First-time OSAHS diagnosis by polysomnography (PSG), fulfilling the diagnostic criteria for OSAHS in the Guidelines for the Diagnosis and Treatment of Obstructive Sleep Apnea Hypoventilation Syndrome (2011 Revision):[28] It was mostly predicated on history, indications, and PSG recording results. OSAHS was diagnosed in those with typical clinical symptoms of nocturnal sleep snoring with apnea, daytime sleepiness (Epworth Sleepiness Scale score ≥9), stenosis and obstruction of any part of the upper airway on physical examination, and apnea-hypopnea index (AHI) ≥5 times/h; a diagnosis of OSAHS was also established in those with unremarkable daytime sleepiness (Epworth Sleepiness Scale score <9), an AHI ≥10 times/h or an AHI ≥5 times/h, and the presence of one or more comorbidities of OSAHS, such as cognitive dysfunction, hypertension, coronary artery disease, cerebrovascular disease, diabetes mellitus, and insomnia; (2) between the ages of 18 and 60; (3) not receiving any OSAHS-related treatment at the moment, such as surgery, a ventilator, or oral orthodontic devices; (4) having good communication and comprehension skills; (5) voluntarily participating in this survey. Individuals who have suffered from mental illness or cognitive impairment in the past that interferes with normal communication, those who have recently taken psychotropic medications, those who have sleep disorders unrelated to OSAHS, and those who have malignant tumors, combined serious cardiopulmonary diseases, or other critical illnesses are all excluded.

Kendall's method was used to estimate the sample size,[29] which was 5–10 times the size of the independent variables. The study included 5 demographic characteristics, 7 dimensions of the quality of sleep scale, 1 dimension of the depression scale, and 5 dimensions of the quality of life scale, totaling 18 independent variables. A total sample size of 90–180 was calculated. The sample size was figured out according to a predetermined statistical power (1-β err prob=0.9) and significance level (α err prob=0.05) according to the methodology proposed by Alexander M. Schoemann on the

sample size needed to identify mediating effects.[30] 90 sample sizes were sufficient to detect mediating effects in this study. Taking into account the 10% lost to follow-up rate, the total sample size required was 99–198 cases. A total of 199 participants were finally included. The First Affiliated Hospital's Ethics Committee at Chongqing Medical University approved the project (No. 2023–294). And following the Helsinki Declaration on Guidelines for Human Research.

Study Tools

Three measures of quality of life, depression severity, and sleep quality were included, in addition to sociodemographic characteristics. Age, gender, Body Mass Index(BMI), marital status, and level of education were among the socio-demographic factors. Gender (male or female), marital status (unmarried, married, divorced, or widowed), and education Level (Junior high school and below, Senior high school, junior college, bachelor's degree, or master's degree and above) were the categories into which they were separated.

Patient Health Questionnaire (PHQ-9)

The degree of depression in OSAHS patients was evaluated using PHQ-9.[31] Each of the nine things on the questionnaire can be graded on a scale of 0 (not at all) to 3 (nearly every day). The sum of the scores from the nine items determines the overall score. A total score of more than 5 was considered to be indicative of depression.No depression was indicated by a score of 0–4, mild depression by a score of 5–9, moderate depression by a score of 10–14, fairly severe depression by a score of 15–19, and severe depression by a score of 20–27. The PHQ-9's Cronbach alpha in our study was 0.857.

Pittsburgh Sleep Quality Index (PSQI)

PSQI was used to measure the quality of sleep throughout the past month.[32] The 17-item PSQI contains seven dimensions: subjective sleep quality, sleep latency, length, habitual sleep efficiency, sleep disorders, use of sleep aids, and dysfunction during the day. Higher scores imply poorer quality sleep. The overall PSQI score is the sum of the scores for the seven dimensions. A sensitive and precise measure of poor sleep quality is a cumulative PSQI score over 5. In this study, the PSQI's Cronbach alpha was 0.683.

Quebec Sleep Questionnaire (QSQ)

OSAHS patients' quality of life was evaluated using QSQ.[33] The scale is a disease-specific health-related quality-of-life tool that was created especially to evaluate how OSAHS affects adult patients' quality of life. It has 32 items total and is divided into five categories: mood, social interactions, nocturnal symptoms, daytime sleepiness, and daytime symptoms. The respondents are asked to respond based on their circumstances over the last four weeks using a seven-point Likert-type scale for the five dimensions. The sum of the five dimensions' scores is the scale's overall score, and OSAHS patients' quality of life improves with a higher score. The scale used in this investigation had a Cronbach alpha coefficient of 0.879.

Data Collection Methods

Following the patients' informed consent, three professionally trained graduate nursing students gathered the data, informed the eligible patients of the study's purpose, pledged to protect their privacy, and distributed the questionnaires. Each study participant voluntarily participated and filled out the questionnaires on their own. In this study, 220 questionnaires were distributed; 199 valid questionnaires were eventually returned, yielding a 90.5% recovery rate. To rigorously preserve the patients' privacy, a number code was used in place of the patient's name in the questionnaire.

Statistical Analysis

The data was analyzed via SPSS 27.0. Categorical variables were represented by frequency and percentage, while continuous variables were represented by mean and standard deviation. The association between properly distributed variables was examined using Pearson correlation. The effect of depression and sleep quality on quality of life were investigated via stepwise multiple linear regression. To account for the influence of confounders, statistical variables about sociodemographic traits were incorporated into the regression model. Using regression-based mediation analysis and the SPSS PROCESS plug-in version 4.1, the mediating role of depression on the association between sleep quality and quality of life was investigated. 95% CIs were constructed for 5000 replicate samples using the robust Bootstrap[34] mediated effects test. There was no mediating effect

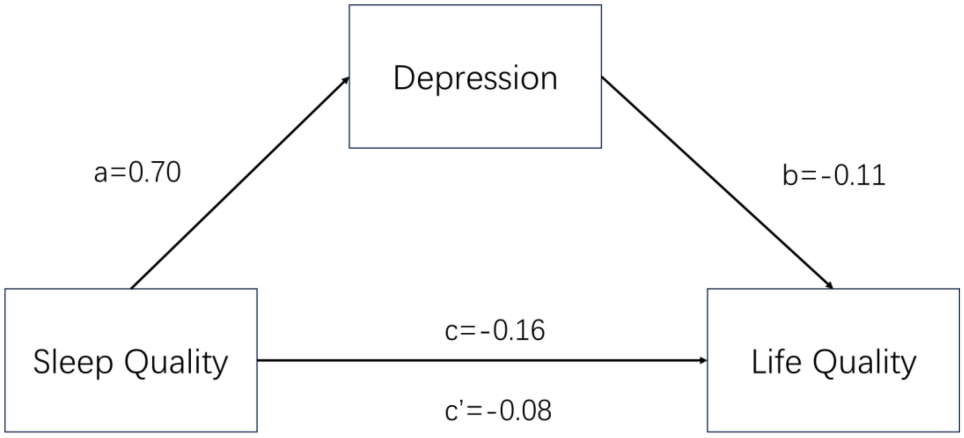

Figure 1 Model of the mediating effect of depression in the relationship between sleep quality and quality of life in these OSAHS patients.

if the indirect effect confidence interval was not statistically significant and contained 0. The influence is deemed considerable if it is devoid of 0. A mediation model was developed using Bootstrap, where sleep quality was the independent variable, depression was the mediator, and quality of life was the dependent variable. The model for the mediating role of depression between sleep quality and quality of life is shown in Figure 1. Figure 1 visualizes the relationship between these three variables of the mediating model of this study. In Figure 1 shows the regression coefficients for the relationship between depression and sleep quality (a) and depression and quality of life (b). The regression coefficient that forecasts the overall impact of sleep quality on life quality is denoted by c.c includes both the direct effect of sleep quality on quality of life c' and the indirect effect of sleep quality on quality of life through depression (a and b). The model in Figure 1 shows that depression mediates the association between sleep quality and quality of life ($\beta = -0.0771$, $p < 0.05$), and mediation effect analysis shows a significant indirect effect of depression on quality of life. The interaction between the three variables can be found in Table 1.

Results

Participant Characteristics

In the end, the study comprised 199 OSAHS patients, whose average age was 39.43±9.85 years. There were 150 male responders or 75.4% of the total. 57.3% of the patients had a bachelor's degree or more, and 76.9% of the patients were married. These OSAHS patients had a BMI of 25.61±3.29. They also had PSQI scores of 7.58±3.83, PHQ-9 scores of 10.85±4.71, and QSQ scores of 5.01±0.96. It implies that the study's patients had bad quality of life, greater degrees of depression, and poor sleep quality. Refer to Table 2 for further information.

Correlations Analysis

According to correlations study, sleep quality in OSAHS patients was favorably connected with depression ($r=0.531$, $p<0.01$), adversely connected with quality of life ($r=-0.713$, $p<0.01$), and negatively related with quality of life ($r=-0.595$, $p<0.01$). There was an adverse relationship between BMI and quality of life ($r=-0.230$, $p<0.01$). Refer to Table 3 for further details.

Table 1 The Mediating Role of Depression Between Sleep Quality and Quality of Life in Patients with OSAHS

Path	Effect Size	Standard Error	95% CI	Effect Size Ratio	p
Indirect Effect	−0.077	0.012	[−0.1020,-0.0550]	49.7%	<0.001***
Direct Effect	−0.078	0.014	[−0.1062,-0.0504]	50.3%	<0.001***
Total Effect	−0.155	0.014	[−0.1838,-0.1269]	100%	<0.001***

Notes: (***p < 0.001).

Table 2 Participant Characteristics (n=199)

Variables	Total (n=199)	Mean ± SD
Gender, n(%)		
Male	150 (75.38%)	
Female	49 (24.62%)	
Age (Years), n(%)		39.43±9.85
BMI		25.61±3.29
Marital Status, n(%)		
Unmarried	33 (16.58%)	
Married	153 (76.88%)	
Divorce	11 (5.53%)	
Widowhood	2 (1.01%)	
Education Level, n(%)		
Junior high school and below	20 (10.05%)	
Senior high school	27 (13.57%)	
Junior college	38 (19.10%)	
Bachelor's Degree	94 (47.24%)	
Master's Degree and above	20 (10.05%)	
Sleep Quality		7.58±3.83
Depression		10.85±4.71

Table 3 Correlations Analysis Between Demographic Characteristics, Sleep Quality, Depression, and Quality of Life of OSAHS Patients

	Gender	Age	BMI	Marital Status	Education Level	Sleep Quality	Depression	Life Quality
Gender	1.000							
Age	0.150*	1.000						
BMI	−0.301**	0.061	1.000					
Marital Status	0.094	−0.236**	−0.122	1.000				
Education Level	−0.126	−0.193**	0.000	−0.052	1.000			
Sleep Quality	0.114	0.191**	−0.023	0.137	0.028	1.000		
Depression	−0.011	−0.106	0.062	0.144*	0.113	0.531**	1.000	
Life Quality	0.064	−0.050	−0.230**	−0.074	−0.054	−0.595**	−0.713**	1.000

Notes: (*p < 0.05, **p < 0.01).

Regression Analysis

The factors affecting OSAHS patients' quality of life were investigated using stepwise multiple linear regression modeling. While there were no notable differences in gender, age, marital status, or educational attainment ($p>0.05$), we did find that these OSAHS patients' quality of life varied significantly across BMI, sleep quality, and depression severity ($p<0.05$). The PSQI score ($\beta=-0.311$, $p<0.01$) and PHQ-9 score ($\beta=-0.542$, $p<0.01$) were found to be substantial indicators of quality of life in OSAHS patients, according to the regression model. Refer to Table 4 for further details.

Mediation Analysis

The PHQ-9's proposed mediating effects were tested using Bootstrap in a 5000-person random sample. The modeling of the mediating function of depression between sleep quality and quality of life demonstrated in Figure 1 holds, with depression partially mediating sleep quality and quality of life in OSAHS patients. Both PHQ-9 and quality of life were significantly impacted by sleep quality (way a: $\beta=0.6972$, 95% CI=0.5479, 0.8465) and PHQ-9 (path b: $\beta=-0.1106$, 95% CI=−0.1328, −0.0884). Sleep quality had substantial effects on quality of life both directly (path c') and overall (path c) ($\beta=-0.0783$, 95% CI =−0.1062, −0.0504 and $\beta=-0.1554$, 95% CI =−0.1838, −0.1269). The PHQ-9 results showed a statistically substantial indirect impact of sleep quality on quality of life ($\beta=-0.0771$, 95% CI=−0.1020, −0.0550). With

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Table 4 Regression Analysis of the Mediating Effect Between OSAHS Patients' Quality of Life and Sleep Quality

Life Quality					
	Unstandardized Coefficients (β)	**Standard Error**	**Standardized Coefficients (β)**	**t**	**p**
Analysis I					
Gender	0.115	0.132	0.052	0.873	0.384
Age	0.006	0.006	0.065	1.084	0.280
BMI	−0.068	0.017	−0.234	−4.028	<0.001***
Marital Status	−0.014	0.091	−0.009	−0.159	0.874
Education Level	−0.015	0.048	−0.018	−0.318	0.751
Sleep Quality	−0.155	0.014	−0.618	−10.779	<0.001***
Depression	–	–	–	–	–
R	0.651				
R2	0.424				
F	23.425				
Analysis II					
Gender	0.097	0.108	0.043	0.899	0.370
Age	−0.004	0.005	−0.039	−0.778	0.437
BMI	−0.055	0.014	−0.187	−3.912	<0.001***
Marital Status	0.016	0.074	0.011	0.222	0.824
Education Level	0.012	0.039	0.015	0.313	0.754
Sleep Quality	−0.078	0.014	−0.311	−5.534	<0.001***
Depression	−0.111	0.011	−0.542	−9.827	<0.001***
R	0.786				
R2	0.618				
F	43.924				

Notes: (*p < 0.05, **p < 0.01,***p < 0.001).

PHQ-9 mediating 49.7% of the overall effect of sleep quality on quality of life, these findings imply that PHQ-9 partly mediates the link between sleep quality and quality of life. Refer to Table 1 for further details.

Discussion

This study sought to determine how depression mediated the connection between OSAHS patients' quality of life and sleep quality. In OSAHS patients, quality of life was found to be negatively connected with both depression and sleep quality, with depression acting as a partial mediating factor in this association. There is evidence to support the hypothesis. These results have significant ramifications for both improving the therapeutic management of individuals with OSAHS and comprehending the mechanisms underlying these factors.

Our findings show a solid correlation between OSAHS patients' sleep quality and their overall quality of life, which is in line with the precursor study.[35,36] Poor sleep quality has also been associated to a lower quality of life for people with OSAHS, according to earlier research.[9] Sleep disturbances are linked to poorer daytime functioning in a variety of emotional, social, and physical dimensions, as well as reduced cognitive and physical functioning. A lower quality of life results from an increase in accidents and absences.[37] Research has indicated that subjective symptoms of sleep problems are linked to a long-term decline in quality of life.[38] The primary cause of OSAHS patients' decreased quality of life is generally acknowledged to be symptoms such as fragmented sleep, nocturnal awakenings, and daytime drowsiness.[39,40]

Depression and sleep quality were found to be favorably connected,[41–43] with a reciprocal relationship between the two.[41,44] The beneficial relationship between depression and sleep quality was also confirmed by our research. The mediating role of depression can be explained by the following processes. Kimberly O'Leary discovered that the relationship between

depressive symptoms and poor sleep quality was mediated by mood regulation.[45] Dopamine and serotonin,[46] two neurotransmitters closely linked to mood regulation, are changed in OSAHS patients as a result of sleep issues. Prolonged sleep deprivation and sleep fragmentation impair the hypothalamic-pituitary-adrenal axis, leading to higher cortisol release and chronic stress,[27] both of which are risk factors for depression. Additionally, low self-esteem and feelings of hopelessness can exacerbate depressive symptoms due to social and functional impairments associated with OSAHS, such as difficulty focusing, decreased productivity,[47] difficulty understanding facial emotions,[34] and strained interpersonal connections.

Our study revealed poorer quality of life in OSAHS patients, Lee's research has shown similar findings[48] and validated that a depressed mood is a powerful predictor of quality of life. These outcomes emphasize how crucial it is for clinicians to screen for and treat depression in OSAHS patients. Prompt detection and treatment of depression symptoms may improve patients' overall quality of life in addition to their mental health. Depression and quality of life are improved by proper treatment of OSAHS.[49–51]

Interestingly, patients' quality of life also sharply declines when their BMI rises, which is a risk factor for the majority of non-communicable illnesses.[52,53] This is in line with the current study's outcomes, which also indicated that BMI had a detrimental effect on OSAHS patients' quality of life. Obesity is positively connected with the severity of OSAHS, and patients with OSAHS frequently have comorbid obesity.[54] A BMI of ≥25 kg/m2 is cited as the cause of sickness in 41% of OSAHS patients.[55] Research has revealed a strong correlation between depression and BMI.[56] Obesity and being overweight are indicators of depression.[57] Raising mood and quality of life is positively impacted by lowering BMI. Because weight loss, medication, and bariatric surgery, if necessary, can reduce the disease's symptoms, it is crucial to lead a healthy lifestyle.[58] The American Thoracic Society recommends that doctors weigh their patients regularly and modify their weight-management regimens to fit their individual preferences. Aggressive weight loss treatments can raise patients' life and reduce the severity of their disease and comorbidities.[59]

Naturally, there are certain restrictions on our study. First, the design of this study was cross-sectional, and the findings show a correlation between OSAHS patients' quality of life, depression, and sleep quality. We were unable to confirm a causal relationship between the three variables or rule out the potential of bidirectional causality because all three were measured at the same time. It was not able to determine whether this pathway varies dynamically over time, despite the study's confirmation that depression mediates the influence of sleep quality on quality of life in OSAHS patients. Future longitudinal research is advised to draw conclusions about causality and achieve deeper comprehension of the temporal relationship between the variables.

Second, even though demographic factors were taken into account, this study did not account for possible confounders such as drug usage and co-morbidities in OSAHS patients. In patients with OSAHS, the use of drugs including sedatives and antihypertensives may disrupt mediating pathways by altering respiratory drive, inflammatory pathways, or sleep architecture.[60] Furthermore, OSAHS frequently coexists with diseases including cardiovascular disease and metabolic syndrome, which can both cause and result from OSAHS.[61,62] The impact of co-morbidities on depression and quality of life vary.[63] Future research must employ stratified sampling to encourage tailored treatment based on the heterogeneity of OSAHS and rigorously gather medication histories and co-morbidities from patients with OSAHS.

Third, the measurement used in our study was self-reported, which makes it susceptible to social desirability and recall bias. The validity of the results may be increased by combining objective sleep quality measures like PSG, portable electronics, and digital platforms for healthcare[64] with a more thorough, multifaceted inspection of depression and quality of life.

Fourth, this study's sample size was small and it only drew from one source. The individuals in this study had lower BMIs and ages than the typical patients with sleep apnea.[3,65] There is some bias in the genuine OSAHS population because the majority of patients selected for the research according to inclusion and exclusion criteria had mild OSAHS, while fewer had moderate-to-severe OSAHS. Future larger multicenter investigations are required to increase sample variety and to confirm and build upon our conclusions.

In summary, this study shows that depression plays a mediator effect between OSAHS patients' quality of life and their sleep quality. For OSAHS to be managed comprehensively, it is essential to clarify the internal mechanisms. To boost the results and OSAHS patients' quality of life, future research should go past the present study's restrictions and delve deeper into the underlying mechanisms and therapies.

Conclusion

This study shows that OSAHS patients typically experience depression and poor sleep quality. In those who have OSAHS, depression was found to be a partial mediator of the connection between sleep quality and quality of life. It was established that depression and sleep quality affected OSAHS patients' quality of life, which offered suggestions for therapeutic measures. Therefore, it is recommended to standardize sleep quality assessment and depression screening for patients in specialized outpatient clinics and sleep centers, which facilitates medical practitioners to quickly identify high-risk populations and intervene with patients for the first time to raise the quality of sleep and depressive mood of OSAHS patients, which is crucial for raising the quality of life of OSAHS patients. More thorough investigations are required in the future to select a more representative group of OSAHS as study subjects, incorporate medication history and co-morbidities, and look for more mediating variables and relevant moderating factors by combining disease severity and sleep monitoring data. The potential factors affecting the quality of life of OSAHS patients should be further explored, and the mechanisms of patients' psychological well-being and standard of life should be done to optimize the intervention strategies and achieve individualized and precise interventions.

Abbreviations

PSQI, Pittsburgh Sleep Quality Index; PHQ-9, Patient Health Questionnaire; QSQ, Quebec Sleep Questionnaire; OSAHS, obstructive sleep apnea-hypopnea syndrome; QOL, quality of life; WHO, World Health Organization; PSG, polysomnography; AHI, apnea-hypopnea index; BMI, Body Mass Index.

Data Sharing Statement

The article contains the original contributions made throughout the investigation.

Ethics Approval and Consent to Participate

The project was approved by the Ethics Committee of Chongqing Medical University's First Affiliated Hospital (No.2023-294). And following the Helsinki Declaration on Guidelines for Human Research.

Consent for Publication

The patients gave their written informed consent so that this study could be published.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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