Investigation of Knowledge, Attitudes, and Practices Related to Pulmonary Rehabilitation Among AECOPD Patients During the Transitional Period After Discharge and Analysis of Influencing Factors

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Abstract

Aims/Background Pulmonary rehabilitation is widely recognized as one of the most effective treatment strategies to improve dyspnea, health status, and exercise endurance in patients with chronic obstructive pulmonary disease (COPD). However, participation in pulmonary rehabilitation among patients experiencing acute exacerbation of COPD remains suboptimal. Current research primarily focuses on the knowledge, attitude, and practice (KAP) of pulmonary rehabilitation among COPD patients during hospitalization or at home, with limited studies investigating the transitional period following discharge. This study aimed to investigate the KAP of pulmonary rehabilitation during the discharge transition period and identify the associated influencing factors, providing significant reference and guidance for improving the rehabilitation outcomes in COPD patients.

Methods This cross-sectional study employed a convenience sampling method to recruit patients with acute exacerbation of COPD (AECOPD) treated at Jiangsu Subei People's Hospital between June 2023 and May 2024. Data collection instruments included a general data questionnaire, a COPD-specific pulmonary rehabilitation KAP questionnaire, and the Mini Nutrition Assessment-Short Form (MNA-SF). Univariate and multivariate linear regression analyses were conducted to identify factors influencing KAP of pulmonary rehabilitation in AECOPD patients during the discharge transition period.

Results A total of 130 questionnaires were distributed, with 128 valid responses collected, yielding an effective response rate of 98.46%. The overall KAP score of AECOPD patients during the discharge transition period was 57.52 ± 8.92. Among the three dimensions, mean scores from the highest to the lowest were attitude (2.54 ± 0.29), practice (2.39 ± 0.36), and knowledge (2.15 ± 0.36). Univariate analysis revealed significant differences in KAP scores based on age, education level, monthly household income per capita, smoking history, degree of dyspnea, and nutritional status of AECOPD patients during the transitional discharge period ($p < 0.05$). Multivariate linear regression identified these same factors as significant influencers of KAP levels ($p < 0.05$).

Conclusion The KAP of pulmonary rehabilitation among AECOPD patients during the discharge transition period is at a moderate level and is significantly influenced by age, educational level, monthly household income per capita, smoking history, degree of dyspnea, and nutritional status. Healthcare professionals should design targeted interventions based on these factors to help patients recognize the importance and necessity of pulmonary rehabilitation, establish correct attitudes about it, and improve compliance with it, thereby improving long-term outcomes.

Key words: chronic obstructive pulmonary disease; symptom flare up; rehabilitation; patient medication knowledge; attitude to health; research

Introduction

Chronic obstructive pulmonary disease (COPD) is a common and severe respiratory disorder characterized by airflow limitation and persistently progressive respiratory difficulties. It is primarily caused by factors such as smoking and air pollution (Ferrera et al, 2021). Acute exacerbation is a frequent occurrence in COPD patients, often resulting in worsened symptoms, including respiratory distress, increased coughing, and elevated sputum production. In severe cases, these episodes can be life-threatening (Mathioudakis et al, 2020). Recent epidemiological data show that approximately 100 million individuals in China are affected by COPD. The disease's recurrent exacerbations and progressive respiratory impairment significantly compromise patients' quality of life (MacLeod et al, 2021). Pulmonary rehabilitation is widely recognized as one of the most effective interventions for improving dyspnea, health status, and exercise tolerance in COPD patients. It has been shown to enhance patients' quality of life, reduce hospital readmissions, and lower mortality rates. As such, it is highly recommended in COPD management guidelines and considered one of the cost-effective treatment strategies (Cornelison and Pascual, 2019). Patients with acute exacerbation of COPD (AECOPD) often have respiratory muscle fatigue and weakness. Pulmonary rehabilitation techniques, such as lip contraction breathing and abdominal breathing, specifically target the training of respiratory muscles. Long-term adherence to training can enhance the strength and endurance of respiratory muscles such as the diaphragm and intercostals, improve respiratory efficiency, reduce respiratory effort, and make breathing more comfortable.

Effective pulmonary rehabilitation enables patients to adopt correct breathing patterns, improve thoracic mobility, and increase pulmonary ventilation. For example, breathing exercises can help expand chest volume, allowing more alveoli to participate in gas exchange, thereby increasing oxygen uptake and carbon dioxide elimination, improving lung ventilation function. Despite these benefits, current engagement in pulmonary rehabilitation among AECOPD patients remains suboptimal. According to recent literature (Wouters et al, 2020), the proportion of COPD patients participating in pulmonary rehabilitation after discharge is less than 2%.

"Transition" refers to the process of shifting from one state, form, or activity to another, while the "transition period" refers to the phase during this change. The discharge transition period is a crucial window for the pulmonary rehabilitation of COPD patients (Aboumatar et al, 2019). Following an acute exacerbation event, patients are required to recover lung function and restore physical capacity. During this phase, appropriate rehabilitation guidance and support can slow disease progression, improve quality of life, and reduce the risk of future acute exacerbations (Nici and ZuWallack, 2018). Currently, research primarily focuses on the analysis of the knowledge, attitude, and practice (KAP) of pulmonary rehabilitation in COPD patients during hospitalization or at home (Jiang et al, 2023; Souto-Miranda et al, 2022a), with limited literature exploring these aspects during the discharge transition period. This study aimed to investigate and analyze the levels of pulmonary rehabilitation-related KAP during the discharge transition period and to

identify the influencing factors. The findings from our study will provide valuable reference and guidance for improving the rehabilitation outcomes of COPD patients, optimizing rehabilitation strategies, and improving the overall treatment effect and quality of life for COPD patients.

Methods

Research Objects

This study employed a cross-sectional design. A convenience sampling method was used to recruit AECOPD patients who were treated at Jiangsu Subei People's Hospital between June 2023 and May 2024 as study subjects. (1) Inclusion criteria: patients diagnosed with AECOPD (Orozco et al, 2024). In such patients with COPD, symptoms such as cough, sputum production, dyspnea, and/or wheezing are aggravated over a short period. These episodes are often accompanied by increased sputum, which is purulent or mucopurulent and may be accompanied by fever and other inflammatory manifestations. Eligible participants were 18 years or older, in the transition period post-discharge (1–3 months after discharge), conscious, with normal communication abilities, informed, and willing to participate in the study. (2) Exclusion criteria: patients with comorbid mental disorders or cognitive impairments; those participating in other similar clinical studies concurrently; individuals diagnosed with malignant tumors; and those with other pulmonary diseases such as pulmonary tuberculosis, bronchiectasis, or obstructive bronchitis. The study protocol complied with the ethical principles of the Declaration of Helsinki, and all participants provided written informed consent.

Sample Size Calculation Method and Research Tools
Sample Size Calculation Method

The sample size was calculated based on the standard requirement in multivariate analysis, which suggests a sample size of 5–10 times the number of variables (van der Boon et al, 2012). With 14 variables included in this study and allowing for a 20% rate of invalid questionnaires, the estimated sample size ranged from 84 to 168 cases. Ultimately, the final sample size was determined as 130 cases.

General Information Survey Form

A self-designed survey was developed by the research team after reviewing relevant domestic and international literature and aligning it with the research objectives. The form collected demographic and sociological data (e.g., gender, age, education level, monthly household income per capita, medical payment method, smoking history, and marital status) and disease-related information (e.g., frequency of acute exacerbations, disease duration, disease severity, number of comorbidities, psychological state, and medication compliance). The degree of dyspnea was assessed using the British Medical Research Council (MRC) scale (Ribeiro et al, 2022), which ranges from 0 to 4 points: 0 points indicate no dyspnea, 1 point indicates mild dyspnea, 2 points indicate moderate dyspnea, 3 points indicate severe dyspnea, and 4 points indicate extremely severe dyspnea.

Pulmonary Rehabilitation Knowledge, Attitude, Practice Questionnaire

The pulmonary rehabilitation knowledge, attitude, practice (KAP) questionnaire for COPD patients was developed by the researchers and comprised three dimensions: knowledge, attitude, and practice related to pulmonary rehabilitation. The instrument contained a total of 23 items. Each item was rated on a 5-point Likert scale, where 1 = 'completely disagree', and 5 = 'completely agree', yielding a total possible score ranging from 23 to 115. Higher scores indicate better knowledge, attitude, and practice of COPD patients related to pulmonary rehabilitation and lower levels of pulmonary rehabilitation-related disorder. The Cronbach's α coefficients for each dimension and the total scale ranged from 0.743 to 0.90, indicating good internal consistency.

Mini Nutritional Assessment-Short Form (MNA-SF)

Revised by Kaiser et al (2009), this scale comprises six items: body mass index (BMI), recent weight loss, acute illness or significant psychological stress, mobility, neurological and psychological disorders, and dietary intake. The total score ranges from 0 to 14, with scores <11 indicating malnutrition and scores ≥ 11 indicating normal nutritional status. The total Cronbach's α coefficient of the scale was 0.711, indicating acceptable internal consistency.

Research Methods

Patients were surveyed during outpatient follow-up visits occurring within 1–3 months after discharge. Two trained and qualified investigators conducted face-to-face questionnaire interviews in a quiet clinic environment with patients who met the inclusion criteria. Before the survey, patients were introduced to the purpose, significance and completion procedures of the study. Standardized instructions were used throughout. After obtaining informed consent, the questionnaire was distributed and filled in by the patient. If the patient experienced difficulty, the investigator helped fill it out. Once completed, the questionnaire was collected immediately, and the invalid responses were excluded.

Statistical Analysis

Data were analyzed using SPSS version 27.0 (IBM, Chicago, IL, USA). The Shapiro-Wilk test was applied for normality of distribution. Measurement data that conformed to the normal distribution were expressed as mean $\pm$ standard deviation (SD). For comparisons, the independent sample t-test or one-way analysis of variance (ANOVA) was used, with least significant difference (LSD) or Tamhane's T2 test applied for post-hoc multiple comparisons as appropriate. Multivariate linear regression analysis was used to identify the influencing factors of KAP of pulmonary rehabilitation among AECOPD patients during the discharge transition period. A p-value < 0.05 was considered statistically significant.

Results

General Information of AECOPD Patients

A total of 130 questionnaires were distributed in this study, of which 128 were valid, resulting in a valid response rate of 98.46%. Among the 128 AECOPD patients, the age range was 59 to 73 years, with a mean age of 61.57 ± 6.81 years. General characteristics of AECOPD patients in Table 1.

Scores of KAP of Pulmonary Rehabilitation in AECOPD Patients During the Discharge Transition Period

The total score of KAP of pulmonary rehabilitation in AECOPD patients during the discharge transition period was 57.52 ± 8.92 points. The average scores of each dimension, ranked from the highest to the lowest, were attitude (2.54 ± 0.29), practice (2.39 ± 0.36), and knowledge (2.15 ± 0.36). Details are shown in Table 2.

Univariate Analysis of KAP of Pulmonary Rehabilitation in AECOPD Patients During the Discharge Transition Period

Scores of pulmonary rehabilitation-related impairments in AECOPD patients during the discharge transition period were compared across subgroups defined by age, education levels, monthly household income per capita, smoking history, degrees of respiratory difficulty, and nutritional status. Statistically significant differences were observed among these subgroups ($p < 0.05$). See Table 3 for detailed results.

Multiple Linear Regression Analysis of KAP of Pulmonary Rehabilitation in AECOPD Patients During the Discharge Transition Period

The total score for pulmonary rehabilitation KAP in AECOPD patients during the discharge transition period was taken as the dependent variable. Variables with statistically significant differences in the univariate analysis were included as independent variables. The assignment of independent variables is shown in Table 4. Results from the multiple linear regression analysis showed that age, education level, monthly household income per capita, smoking history, degree of dyspnea, and nutritional status were the significant influencing factors for KAP of pulmonary rehabilitation in AECOPD patients during the transitional period ($p < 0.05$). See Table 5 for detailed results.

Discussion

Current Status of KAP of Pulmonary Rehabilitation in AECOPD Patients During the Discharge Transition Period

Pulmonary rehabilitation is widely recognized as one of the most effective therapeutic strategies for improving dyspnea, health status, and exercise endurance in patients with COPD (Gao et al, 2024). It can significantly enhance patients' quality of life, reduce the risk of complications, slow disease progression, and improve rehabilitation outcomes and survival rates (Hansen et al, 2020). In this study, a total of 130 questionnaires were distributed, and 128 valid responses were obtained, yielding an

Table 1. General characteristics of AECOPD patients (n = 128).

Variable	Category	Number of cases	Percentage (%)
Gender	Male	81	63.28
	Female	47	36.72
Age	18–59 years	49	38.28
	≥60 years	79	61.72
Education level	Middle school or below	52	40.63
	Technical school or high school	35	27.34
	College or above	41	32.03
Medical payment type	Medical insurance	88	68.75
	Self-payment	40	31.25
Monthly household income per capita	≤5000 CNY	72	56.25
	>5000 CNY	56	43.75
Smoking history	Yes	43	33.59
	No	85	66.41
Marital status	Married	103	80.47
	Unmarried/divorced/other	25	19.53
Number of acute exacerbations (past year)	<5 times/year	91	71.09
	≥5 times/year	37	28.91
Disease duration	<5 years	57	44.53
	≥5 years	71	55.47
Degree of dyspnea	None/mild/moderate	89	69.53
	Severe/extremely severe	39	30.47
Number of comorbidities	0 condition	62	48.44
	1–2 conditions	56	43.75
	≥3 conditions	10	7.81
Nutritional status	Malnutrition	57	44.53
	Normal nutrition	71	55.47
Psychological status	Good	78	60.94
	General	50	39.06
Medication compliance	Good	81	63.28
	Poor	47	36.72

AECOPD, acute exacerbation of chronic obstructive pulmonary disease. 1 CNY ≈ 0.1391 USD.

Table 2. Scores of KAP of pulmonary rehabilitation in AECOPD patients during the discharge transition period (points, $\bar{x} \pm S$).

Dimension	Number of items	Score range	Total score (mean ± SD)	Average item score (mean ± SD)
Knowledge	9	9–45	22.21 ± 5.89	2.15 ± 0.36
Attitude	4	4–20	10.25 ± 2.18	2.54 ± 0.29
Practice	10	10–50	26.12 ± 6.87	2.39 ± 0.36
Total score	23	23–115	57.52 ± 8.92	2.40 ± 0.45

KAP, knowledge, attitude, and practice.

Table 3. Univariate analysis of pulmonary rehabilitation KAP scores in AECOPD patients during the discharge transition period.

Variable	Category	Number of cases	KAP scores (point, $\bar{x} \pm S$)	t/F value	p-value
Gender	Male	81	57.88 ± 8.85	0.301	0.764
	Female	47	57.39 ± 8.94		
Age	18–59 years	49	59.91 ± 4.26	2.738	0.007
	≥60 years	79	57.25 ± 5.91		
Education level	Middle school or below	52	54.21 ± 8.15	4.337	0.015
	Technical/high school	35	57.69 ± 7.62		
	College or above	41	58.46 ± 6.23		
Medical payment type	Medical insurance	88	57.19 ± 8.87	0.250	0.803
	Self-payment	40	57.61 ± 8.65		
Monthly household income per capita	≤5000 CNY	72	54.19 ± 7.74	3.382	0.001
	>5000 CNY	56	58.82 ± 7.61		
Smoking history	Yes	43	56.03 ± 6.45	2.142	0.034
	No	85	58.97 ± 7.74		
Marital status	Married	103	57.35 ± 8.99	0.155	0.877
	Unmarried/divorced/other	25	57.04 ± 8.82		
Number of acute exacerbations (past year)	<5 times/year	91	57.89 ± 8.87	0.375	0.708
	≥5 times/year	37	57.24 ± 8.95		
Disease duration	<5 years	57	57.91 ± 8.77	0.417	0.677
	≥5 years	71	57.26 ± 8.75		
Degree of dyspnea	None/mild/moderate	89	58.15 ± 5.42	3.430	0.001
	Severe/extremely severe	39	54.12 ± 7.49		
Number of comorbidities	0 condition	62	57.82 ± 8.63	0.040	0.961
	1–2 conditions	56	57.49 ± 8.75		
	≥3 conditions	10	57.11 ± 8.84		
Nutritional status	Malnutrition	57	55.28 ± 6.25	2.149	0.034
	Normal nutrition	71	58.45 ± 9.62		
Psychological status	Good	78	58.24 ± 8.54	0.662	0.509
	General	50	57.16 ± 9.68		
Medication compliance	Good	81	59.26 ± 8.14	1.408	0.162
	Poor	47	57.11 ± 8.65		

KAP, knowledge, attitude, and practice. 1 CNY ≈ 0.1391 USD.

Table 4. Variable assignment criteria.

Variable	Value assignment method
Age	$\geq$60 years = 0, 18–59 years = 1
Education level	Middle school or below = 0, Technical or high school = 1, College or above = 2
Monthly household income per capita	$\leq$5000 CNY = 0, >5000 CNY = 1
Smoking history	Yes = 0, No = 1
Degree of dyspnea	Severe or extremely severe = 0, None, mild or moderate = 1
Nutritional status	Malnutrition = 0, Normal nutrition = 1

1 CNY $\approx$ 0.1391 USD.

effective response rate of 98.46%. The total score for KAP of pulmonary rehabilitation among AECOPD patients during the discharge transition period was 57.52 $\pm$ 8.92 points. These findings are consistent with the findings reported by Frei et al (2022), suggesting that the level of knowledge, beliefs, and practice related to pulmonary rehabilitation among AECOPD patients during the transition period is moderate.

Among the three dimensions of pulmonary rehabilitation impairments evaluated, the scores ranked from the highest to the lowest were attitude (2.54 $\pm$ 0.29), practice (2.39 $\pm$ 0.36), and knowledge (2.15 $\pm$ 0.36). These findings indicate that while AECOPD patients exhibit a certain level of motivation toward pulmonary rehabilitation training, their understanding of relevant knowledge about pulmonary rehabilitation remains relatively limited. This lack of knowledge may contribute to irregular training practices and suboptimal adherence to rehabilitation protocols (Xie et al, 2020). Behavioral research has shown that behavior change is often driven by the transformation of sufficient knowledge into belief systems, which in turn guide behavioral responses (Thabet et al, 2022). Therefore, identifying and analyzing the influencing factors that affect patients' knowledge, beliefs, and behaviors can help formulate personalized intervention strategies and enable patients to derive greater benefits from pulmonary rehabilitation programs.

Influencing Factors of KAP of Pulmonary Rehabilitation in AECOPD Patients During the Discharge Transition Period

The results of the multiple linear regression analysis showed that age, education level, monthly household income per capita, smoking history, degree of dyspnea, and nutritional status were significant factors influencing the KAP of pulmonary rehabilitation in AECOPD patients during the discharge transitional period. These findings are consistent with those reported by Adolfo et al (2019). Selzler et al (2012) highlighted age as an important factor influencing compliance with pulmonary rehabilitation training in COPD patients, suggesting that as patients age increases and lung function declines, their physical condition may worsen, thereby reducing their motivation to engage in rehabilitation training. Studies have also indicated that patients with lower education levels often face limitations in conceptual understanding, cognitive abilities, and access to health information. Additionally, patients with lower education levels may lack access to reliable channels to obtain

Table 5. Multiple linear regression analysis of KAP of pulmonary rehabilitation in AECOPD patients during the discharge transition period.

Variable	Partial regression coefficient	Standard error	Standardized coefficient	t-value	p-value
Constant	16.412	3.156	-	5.339	<0.001
Age	1.892	0.415	0.174	3.624	<0.001
Education level (technical school or high school)	1.112	0.841	0.245	1.021	0.098
Education level (college or above)	1.423	0.315	0.177	3.074	0.002
Monthly household income per capita	2.330	0.308	0.169	4.105	<0.001
Smoking history	1.764	0.274	0.151	2.964	0.015
Degree of dyspnea	2.215	0.117	0.177	2.852	0.019
Nutritional status	1.974	0.165	0.182	2.731	0.021

Note: $R^2 = 0.422$, Adjusted $R^2 = 0.416$, $F = 16.218$, $p < 0.001$.

health information and receive social support. This can result in limited understanding and insufficient assistance from others, ultimately affecting compliance with rehabilitation training (Rochester, 2024). Ji et al (2023) reported that individuals with lower education levels often have limited health self-management capabilities, making it challenging for them to effectively develop and adhere to rehabilitation training plans. These findings suggest that healthcare professionals should tailor their health educational strategies by using simple, clear, and accessible methods to explain the knowledge, methods, and benefits of pulmonary rehabilitation to patients with lower education levels.

The traditional perception is that pulmonary rehabilitation depends heavily on healthcare professionals, must be conducted in clinical settings, is procedurally complex, and requires a high cost. Coupled with the limited awareness of pulmonary rehabilitation among COPD patients, this perception may lead them to believe that it requires long-term and significant financial investment. Patients from low-income households may experience more psychological burdens, which can reduce their motivation and compliance with pulmonary rehabilitation protocols, exacerbating the impairments. Additionally, patients with limited financial resources may lack access to sufficient rehabilitation resources and support, such as being unable to afford private rehabilitation fees or benefit from social assistance programs (Jing et al, 2023). Numerous studies have confirmed that smoking is a primary risk factor for COPD (Pal et al, 2022; Souto-Miranda et al, 2022b). Previous research has shown that a prolonged smoking history contributes to impaired lung function, which in turn reduces physical tolerance and compliance with rehabilitation training (Sami et al, 2021). AECOPD patients often suffer from severe dyspnea during the acute phase, and these symptoms may persist post-discharge, limiting physical activity and motivation, leading to decreased compliance with rehabilitation training.

COPD is a chronic and debilitating disease, and evidence indicates that malnutrition is a significant factor influencing the physical training capacity of COPD pa-

tients, potentially resulting in reduced compliance with rehabilitation training (Hu et al, 2020). These observations highlight the need for healthcare professionals to monitor and address the nutritional status of COPD patients, offer psychological support and mental health services, and assist patients in managing stress. Additionally, targeted health education should be provided to guide patients in adopting healthy lifestyles and to ensure equitable access to essential rehabilitation resources. By implementing comprehensive intervention measures, the adverse effects of the identified influencing factors on pulmonary rehabilitation among AE-COPD patients can be mitigated, and rehabilitation outcomes can be improved.

This study has several limitations that warrant in-depth consideration. First, a cross-sectional design was employed. While this design allows for the description of the relationship between the characteristics of the research participants and relevant variables at a specific time point, it also introduces potential sources of bias. On the one hand, there may be selection bias. Due to the inclusion and exclusion criteria and the voluntary nature of participation, the sample may not fully represent the broader target population. On the other hand, information bias is a common concern in cross-sectional studies. During data collection, inaccuracies may arise from recall bias or limitations in measurement tools. For example, when collecting patients' medical history or lifestyle habits, memory lapses or misunderstandings may lead to incomplete or inaccurate responses, thus affecting the authenticity of the research findings. Furthermore, this study lacks long-term follow-up data. Longitudinal data are crucial for assessing disease progression, long-term treatment effects, and prognosis. The absence of long-term follow-up limits the ability to assess the long-term stability of the findings and hinders the evaluation of key indicators such as recurrence and complication rates of the disease over time. In the future, research should consider adopting a longitudinal cohort design to enable extended follow-up of participants. This would help reduce bias associated with cross-sectional design and obtain more comprehensive long-term data to facilitate accurate evaluation of the natural course of the disease and the long-term impacts of therapeutic interventions.

Conclusion

During the discharge transition period, AECOPD patients exhibit a moderate level of KAP related to pulmonary rehabilitation. These are influenced by factors such as age, education level, monthly household income per capita, smoking history, degree of dyspnea, and nutritional status. Healthcare professionals should develop targeted interventions based on these influencing factors to enhance patients' understanding of the significance and necessity of pulmonary rehabilitation, foster accurate beliefs about it, and improve adherence to pulmonary rehabilitation behaviors.

> ## Key Points
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> - Pulmonary rehabilitation disorders in AECOPD patients during the discharge transition period still require targeted alleviation.
> - While AECOPD patients exhibit strong motivation for pulmonary rehabilitation, their lack of relevant knowledge limits effective implementation.
> - Age, education level, monthly household income per capita, smoking history, and degree of dyspnea are related to pulmonary rehabilitation disorders in AECOPD patients.
> - Nutritional status significantly influences the level of KAP of pulmonary rehabilitation among AECOPD patients.

Availability of Data and Materials

All data included in this study are available from the corresponding author upon reasonable request.

Author Contributions

TTZ and XYC designed the research study. TTZ, FL and XYZ performed the research. JJY and QW analyzed the data. TTZ drafted the manuscript. JXB is responsible for reviewing documents, supervising research, and making substantial contributions to the interpretation of the study data. All authors contributed to the important editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This study was approved by the Medical Ethics Committee of Yangzhou University (YZUHL20210128). The study protocol complied with the ethical principles of the Declaration of Helsinki, and all participants provided written informed consent.

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Conflict of Interest

The authors declare no conflict of interest.

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