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Correlation Analysis Between Symptom Clusters and Quality of Life in Patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease

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Abstract: *Objective*: This study aims to investigate the patterns of symptom occurrence in patients experiencing acute exacerbations of chronic obstructive pulmonary disease (AECOPD). It will explore the composition of symptom clusters and analyze the correlation between these clusters and health-related quality of life (HRQoL). *Methods*: A total of 207 patients with AE-COPD were surveyed from a tertiary grade A hospital. Data collection was conducted using three validated instruments: the Basic Information Questionnaire (BIQ), Disease Symptom Survey Questionnaire (MSAS), and Quality of Life Questionnaire (CAT). Statistical software SPSS 22.0 was used to analyze the correlation between symptom clusters and quality of life. *Results*: Exploratory factor analysis showed that five major symptom clusters existed in the patients, including the psycho-emotional symptom cluster, the sleep-related symptom cluster, the other side effects symptom cluster, the energy deficiency symptom cluster and the cough-loss of appetite symptom cluster, and the severity of the symptom clusters showed a significant negative correlation with the quality of life of the patients ($P < 0.05$). *Conclusion*: Strengthening the comprehensive management of symptom clusters in patients with AE-COPD can help to effectively reduce the symptom burden of patients, and then significantly improve their quality of life.

Keywords: COPD; Acute exacerbation; Symptom cluster; Quality of life

Online publication:

1. Introduction

Chronic obstructive pulmonary disease (COPD) is a respiratory disease characterized by persistent airflow limitation, with high morbidity and mortality rates, and is now one of the three leading causes of death in the world, bringing a heavy burden to patients, families, and society [1]. Acute exacerbation (AE-COPD), as a key stage in the course of COPD, causes serious injury to patients' lung function, accelerates the malignant progression of

the disease, aggravates the degree of respiratory distress, and reduces the quality of life, which greatly affects the patients' physical function and prognosis [2–4]. Currently, most domestic and international studies on COPD focus on the stabilization period, while there are relatively few studies on the symptom clusters of AECOPD patients, especially the correlation between the symptom clusters and the quality of life is even more scarce. This study aims to analyze the composition of symptom clusters and their correlation with the quality of life of AE-COPD patients, so as to provide a scientific basis for the clinical development of more precise and effective interventions, and thus effectively improve the quality of life of patients.

2. Methods

2.1. Participants

Using convenience sampling, a total of 207 patients hospitalized with AE-COPD were consecutively recruited from the Department of Pulmonary and Critical Care Medicine at a tertiary grade A hospital between January 2024 and January 2025. A questionnaire survey was conducted by trained researchers through direct distribution. Based on the sample size calculation principle (5–10 variables per case) and accounting for a 20% anticipated attrition rate, a total of 220 questionnaires were administered. The inclusion criteria were as follows: (1) Meeting the 2020 diagnostic and treatment guidelines for COPD issued by the Chinese Thoracic Society, with pulmonary function classified as GOLD stages 1–4; (2) Aged between 18 and 80 years; (3) Provision of written informed consent by the patient. The exclusion criteria included: (1) Current participation in other interventional clinical studies; (2) Presence of comorbid respiratory diseases (e.g., pulmonary tuberculosis, asthma); (3) Concurrent neurological or psychiatric disorders.

2.2. Instruments

2.2.1. Basic information questionnaire

This questionnaire includes the patient's demographic information (e.g., gender, age, education, etc.), basic disease profile (e.g., year of COPD diagnosis, number of acute exacerbations in the last 12 months, etc.), comorbidities (e.g., cardiovascular disease, metabolic disease, etc.), and degree of dyspnea (using the modified Medical Research Council Dyspnea Score, mMRC).

2.2.2. Symptoms of Illness Questionnaire (MSAS)

This questionnaire was developed by Portenoy *et al.* in the mid-1990s to assess the frequency, severity, and degree of distress of the patient's symptoms in the last 7 days. The questionnaire contains 32 common symptoms, and patients rate each symptom according to their own conditions. The MSAS has good reliability and validity, with an internal consistency coefficient (Cronbach's α) of 0.92 and a retest reliability of 0.89, which is able to effectively assess the patients' symptoms.

2.2.3. Quality of Life Questionnaire (CAT)

This questionnaire was developed by Jones *et al.* in 2009 and was specifically designed to assess the impact of COPD on patients' quality of life. The questionnaire contains 8 entries with a total score of 0-40, with higher scores indicating poorer quality of life. The CAT scale has good reliability and validity, with an internal consistency coefficient (Cronbach's α) of 0.85 and a re-test reliability of 0.83, which can effectively assess the

quality of life of patients with chronic obstructive pulmonary disease (COPD).

2.3. Data analysis

Data were analyzed using SPSS 22.0 statistical software. Descriptive statistics were employed to summarize the basic information and symptom occurrences of the patients. Exploratory factor analysis (EFA) was conducted to identify the types and numbers of symptom clusters. Multiple linear regression analysis was performed to investigate the factors influencing the severity of the symptom clusters, while Spearman's rank correlation analysis was utilized to evaluate the relationship between symptom clusters and quality of life.

3. Results

3.1. Demographic characteristics

A total of 207 valid questionnaires were returned, yielding an effective response rate of 94.09%. The cohort comprised 152 males (73.4%) and 55 females (26.6%), with a mean age of 64.3 ± 9.8 years. The median duration since COPD diagnosis was 5 years (IQR: [range to be calculated]). Patients with mMRC grade 4 accounted for 47.8%, and 42.0% reported a monthly household income between ¥1,000–3,000. Detailed demographic and clinical characteristics are presented in **Table 1**.

Table 1. Demographic characteristics of patients with AE-COPD (n=207)

Variables	Category	Number of cases	Percentage (%)
Gender	Male	152	73.43
	Female	55	26.57
Living Situation	Living alone	11	5.31
	Living with spouse	79	38.16
	Living with children	30	14.49
	Living with spouse and children	87	42.03
Place of Residence	Rural	74	35.75
	County/town	78	37.68
	City	55	26.57
Religious Belief	Yes	14	6.76
	No	193	93.24
Employment Status	Unemployed or not working	95	45.89
	Employed	25	12.07
	Retired	87	42.03
Marital Status	Married	173	83.58
	Not married	34	16.42
Household Income	Below 1000 RMB	45	21.74
	1000–3000 RMB	87	42.03
	3000–5000 RMB	55	26.57
	Above 5000 RMB	20	9.66

Table 1 (Continued)

Variables	Category	Number of cases	Percentage (%)
Financial Burden of Disease	Mild	32	15.46
	Moderate	93	44.93
	Severe	82	39.61
mMRC Grade	Grade 2	44	21.26
	Grade 3	64	30.92
	Grade 4	99	47.83
Mode of Admission	Emergency admission	2	0.97
	Outpatient admission	205	99.03
Duration Since Diagnosis of COPD	≤ 1 year	42	20.29
	1–5 years (excluding 5)	102	49.28
	5–10 years (excluding 10)	53	25.60
	> 10 years	10	4.83
Number of Acute Exacerbations of COPD in the Past 12 Months	1	85	41.06
	2	61	29.47
	3	45	21.74
	4	8	3.87
	5	4	1.93
	6	2	0.97
Number of COPD-related Hospitalizations in the Past 12 Months	1	48	23.19
	2	49	23.67
	3	56	27.05
	4	23	11.11
	5	16	7.73
	6	8	3.87
	7	7	3.38
Comorbidities	Other	53	25.60
	None	6	2.90
	Cardiovascular diseases	129	62.32
	Metabolic diseases	19	9.18
Severity of Comorbidities	None or mild	51	24.64
	Moderate	97	46.86
	Severe	59	28.50
Smoking Status	Never smoked	74	35.75
	Former smoker	98	47.34
	Current smoker	35	16.91

Table 1 (Continued)

Variables	Category	Number of cases	Percentage (%)
Alcohol Consumption	Never drinks	116	56.04
	Former drinker	70	33.82
	Current drinker	21	10.15
Regular Physical Activity	Yes	87	42.03
	No	120	57.97
Age	≤ 50 years	18	8.70
	51–60 years	33	15.94
	61–70 years	76	36.71
	71–80 years	80	38.65
Highest Educational Level	Illiterate	6	2.90
	Primary school	99	47.83
	Junior high school	71	34.30
	High school / technical secondary school	25	12.08
	College and above	6	2.90

3.2. Symptom occurrence

The top five symptom occurrences of the patients were: shortness of breath (100%), cough (100%), dry mouth (92.3%), difficulty in sleeping (89.9%), and worry (88.4%). From the comprehensive analysis of the frequency, severity, and degree of distress of symptoms, shortness of breath, cough, dry mouth, difficulty in sleeping, and worry had the greatest impact on the patients. Detailed symptom occurrences are shown in **Table 2**.

Table 2. Occurrence of symptoms in AE-COPD (n=207)

Symptom	Frequency	Incidence Rate (%)	Mean score
Shortness of breath	207	100(1)	3.04(1)
Cough	207	100(1)	2.45(2)
Dry mouth	191	92.3(2)	1.97(4)
Difficulty falling asleep	186	89.9(3)	2.38(3)
Anxiety	183	88.4(4)	1.75(5)
Feeling of sadness	170	82.1(5)	1.49
Loss of appetite	170	82.1(5)	1.49
Feeling irritable	156	75.4	1.35
Drowsiness	141	68.1	1.27
Feeling nervous	137	66.2	1.18
Sweating	136	65.7	1.17
Difficulty concentrating	108	52.2	0.93
Pain	103	49.8	1.03
Swelling in legs or arms	96	46.4	0.76

Table 2 (Continued)

Symptom	Frequency	Incidence Rate (%)	Mean score
I don't look like myself	73	35.3	0.64
Nausea	62	30	0.45

○ means the numbers in "○" in the table indicate the ranking of the symptom.

3.3. Quality of life

The patients' total quality of life score was (28.66 ± 4.84), with the highest score for daily situation (11.52 ± 2.63), the score for physiological situation was (9.87 ± 2.13); and the score for mental situation was (7.26 ± 1.51). This indicates that the overall quality of life of AE-COPD patients is at a low level, especially as daily activities and mental status are seriously affected.

3.4. Symptom cluster

Five major symptom clusters were extracted by EFA, and the symptom composition and variance contribution rate of each symptom cluster were as follows. The variance contribution rate of psycho-emotional cluster (feeling of sadness, worry, feeling irritable, feeling nervous) was 23.407%. The variance contribution of sleep-related cluster (difficulty falling asleep, shortness of breath, arm edema, I don't look like myself) was 13.591%. The variance contribution of other side effects cluster (pain, dry mouth, sweating, nausea) was 11.2%. The variance contribution of energy deficiency cluster (low energy, feeling lethargic) was 7.908%. The variance contribution of Cough-anorexia cluster (cough, loss of appetite) was 7.095%. The symptom component loading matrix for each symptom cluster is shown in **Table 3**.

Table 3. Matrix of symptom component loadings in patients with AE-COPD

Symptom	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Sadness	0.832				
Anxiety	0.805				
Irritability	0.747				
Nervousness	0.528				
Difficulty falling asleep		0.628			
Shortness of breath		0.699			
Swelling in arms		0.695			
I don't look like myself		0.681			
Pain			0.666		
Dry mouth			0.560		
Sweating			0.726		
Nausea			0.544		
Lack of energy				0.583	
Drowsiness				0.823	
Loss of appetite					0.520

Table 3 (Continued)

Symptom	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Cough					0.857
Symptom Group Label	Psychological-Emotional	Sleep-Related	Side Effect-Related	Low Energy	Cough–Appetite Loss
Cronbach's α	0.760	0.658	0.593	0.586	0.373
Variance Explained (%)	23.047	13.591	11.2	7.908	7.095
Cumulative Variance (%)	23.047	36.638	47.838	55.746	62.84

3.5. Analysis of influence factors

Multivariate linear regression analysis identified the following predictors for symptom cluster severity.

(1) Psycho-emotional cluster: alcohol consumption, residence, mMRC grade, household income.

(2) Sleep-related cluster: mMRC grade, comorbidity severity, disease economic burden.

(3) Other side effects cluster: comorbidity severity, employment status, gender, household income.

(4) Energy deficiency cluster: smoking status, physical activity, disease economic burden, employment status, alcohol consumption, age, COPD exacerbation frequency.

(5) Cough-anorexia cluster: mMRC grade.

3.6. Correlation analysis

The results of Spearman rank correlation analysis showed that the severity of each symptom cluster was negatively correlated with the total quality of life score and the scores of each dimension ($P < 0.05$). Among them, the sleep-related symptom cluster had the strongest correlation with the total quality of life score ($r = -0.626$, $P < 0.001$). The results of the detailed analysis was shown in **Table 4**.

Table 4. Correlation between the severity of each symptom cluster and quality of life in patients with AE-COPD

Symptom group	Physical condition (r)	Daily condition (r)	Mental condition (r)	Total score (r)
Psychological-Emotional Symptom Group	-0.235**	-0.267**	-0.296**	-0.333**
Sleep-Related Symptom Group	-0.302**	-0.560**	-0.594**	-0.626**
Other Side Effects Symptom Group	-0.166*	-0.119	-0.298**	-0.213**
Low Energy Symptom Group	-0.246**	-0.205**	-0.205**	-0.272**
Cough–Appetite Loss Symptom Group	-0.351**	-0.315**	-0.130	-0.367**

*Correlation is significant at the 0.05 level (two-tailed).

**Correlation is significant at the 0.01 level (two-tailed).

4. Discussion

The findings of this study revealed that patients experiencing acute exacerbations of chronic obstructive pulmonary disease (AE-COPD) exhibit a diverse array of symptoms, with notably high prevalence rates. Among these, respiratory manifestations—including dyspnea and cough—are the most ubiquitous, reaching a 100% occurrence rate. This observation aligns with the results reported by Yang *et al.*, underscoring the profound detrimental impact of these respiratory symptoms on pulmonary function [5]. Concurrently, non-respiratory symptoms such as

sleep disturbances and psychosocial issues were prominently identified. Insufficient sleep duration significantly exacerbated patients' fatigue severity, while psychosocial comorbidities correlated with prolonged disease duration, deteriorating pulmonary function, impaired physical mobility, and diminished health-related quality of life (HRQoL) [6, 7]. Collectively, these findings suggest that clinical nursing staff should prioritize strengthening symptom management strategies, optimizing integrated clinical treatment-nursing workflows, and implementing precision nursing interventions to achieve efficient disease management. Such efforts would enable patients to perceive a tangible sense of control and improvement over their symptoms, thereby enhancing therapeutic adherence and clinical outcomes.

The total quality of life score of the 207 AE-COPD patients included in this study was (28.66 ± 4.84). According to the total score of CAT scale, it indicated that the mean score of quality of life of the patients in this study was in the severe stage of the disease, and most of the patients had a low quality of life [8]. Analysis of the mean scores of each dimension revealed that the highest score of daily situation (11.52 ± 2.63) indicated that COPD had a great impact on the daily life of the patients; the score of physiological situation (9.87 ± 2.13); and the score of mental situation (7.26 ± 1.51) showed that the mental state of the patients was also seriously affected. This shows that the quality of life of AE-COPD patients is low and needs to be highly emphasized in clinical practice.

The symptom clusters observed in patients with acute exacerbations of chronic obstructive pulmonary disease (AE-COPD) include the psycho-emotional cluster, sleep-related cluster, other side effects cluster, energy deficiency cluster, cough-anorexia cluster. Among these, the psycho-emotional and sleep-related clusters exerted a more pronounced impact on patients' quality of life. The psycho-emotional symptom cluster may arise from the acute exacerbation of the disease, significant alterations in the patient's body and lifestyle, leading to feelings of maladjustment and powerlessness regarding their condition [9]. Furthermore, the severity of sleep-related symptom cluster demonstrated a significant positive correlation with patients' physical, daily, mental, and overall quality of life scores, as evidenced by studies conducted by some international scholars [10]. The side effect cluster encompassed pain, dry mouth, sweating, nausea, and other symptoms. Research has indicated that pain is an integral component of the disease process that cannot be overlooked, as it exacerbates the severity of both physical and mental symptoms, thereby creating a negative synergistic relationship among the symptoms [11]. Additionally, there was a correlation between energy deficiency cluster and the severity of COPD symptoms. Studies have shown that the incidence of energy deficiency issues, such as lack of energy, drowsiness, and fatigue, is positively correlated with the severity of acute exacerbations in COPD patients. These energy deficiency symptoms negatively impact the psychological state of the patient, potentially leading to a loss of self-awareness and even cognitive decline [12]. Lastly, the cough-anorexia cluster, which includes both cough and loss of appetite, exhibits a significant positive correlation with the patients' physiological condition.

In this study, it is found that the severity of each symptom cluster is negatively correlated with quality of life, suggesting that alleviating the symptom burden can significantly enhance patients' quality of life. Key factors influencing the corresponding symptom clusters included family income, mMRC dyspnea class, residence status, disease duration, smoking status, physical activity, economic burden, degree of comorbidity, age, and number of hospital admissions. These findings align closely with those of Lim *et al.* [13, 14]. Therefore, it is imperative to implement targeted interventions in clinical practice to improve the quality of life for patients. Relevant studies have demonstrated that the implementation of effective respiratory rehabilitation care significantly enhances patients' lung function [15]. This includes utilizing respiratory muscle training to counteract respiratory muscle

atrophy, alleviate respiratory distress, and improve sputum expectoration capabilities, which are crucial for mitigating the severity of the disease. Furthermore, the severity and number of comorbidities correlate with the symptoms of acute exacerbation of COPD [16]. Consequently, healthcare personnel must promptly assess patients' comorbidity situations and administer appropriate management strategies tailored to the various types and degrees of comorbidities. This approach aims to facilitate timely interventions and effective treatments for patients with specific comorbid conditions. It is also essential to strengthen psychological counseling for patients with chronic illnesses, particularly focusing on educating those who have experienced multiple hospital admissions. Additionally, greater medical attention and humanistic care should be directed towards rural patients, individuals with limited economic resources, and elderly patients. Post-discharge, patients are encouraged to engage in physical activities and respiratory rehabilitation training to enhance lung function and respiratory health. It is advisable to gradually improve their physical capabilities through walking, Baduanjin, and Tai Chi, thereby facilitating the enhancement of various bodily functions through appropriate exercise [17].

There were some limitations in this study that cannot be neglected. The generalizability of our findings may be constrained by the limited sample size and geographical scope of this study. Furthermore, while the MSAS and CAT utilized in this research demonstrate considerable clinical utility, their predefined symptom inventories and patient-reported outcome (PRO) items may introduce measurement limitations, potentially affecting the comprehensiveness of our results. Future investigations should prioritize expanding sample diversity through multicenter recruitment, implementing longitudinal designs to elucidate symptom cluster trajectories, and employing mixed-methods approaches to examine sustained associations between symptom dynamics and health-related quality of life (HRQoL). These enhancements would provide more robust evidence for optimizing symptom management protocols in clinical nursing practice.

5. Conclusion

This study investigated the characteristics of symptom clusters and their correlation with quality of life in patients with AE-COPD. The findings revealed the existence of five major symptom clusters among the patients, with the severity of each cluster showing a significant negative correlation with their quality of life. Comprehensive management of these symptom clusters is expected to significantly enhance patients' quality of life and improve their prognosis.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Kong D, Fan Z, 2021, Progress of Research on the Correlation Between Chronic Obstructive Pulmonary Disease and Air Pollution. China Public Health, 37(9): 1438–1442.

[2] Li L, Cui M, Zhao L, 2012, Role of Breathing Training on Fatigue in Stable COPD Patients. Journal of Nurse Advancement, 27(15): 1398–1400.

[3] Yang H, Shi X, Wang D, et al., 2019, Progress of Research on Early Warning of Acute Exacerbation of Chronic Obstructive Pulmonary Disease. International Respiratory Journal, 39(12): 5.

[4] Theander K, Jakobsson P, Torstensson O, et al., 2008, Severity of Fatigue Is Related to Functional Limitation and Health in Patients With Chronic Obstructive Pulmonary Disease. International Journal of Nursing Practice, 14(6): 455–462.

[5] Yang ZJ, Cui ML, Zhang SF, et al., 2021, Symptom Clusters and Their Correlation With Inflammatory Factor Levels in Patients With Chronic Obstructive Pulmonary Disease. Nursing Research, 35(7): 1134–1139.

[6] Chen QM, Cui ML, Ma YE, 2022, Investigation and Study of Symptom Clusters and Antecedent Symptoms in Patients With Acute Exacerbation of Chronic Obstructive Pulmonary Disease. Chinese Journal of Nursing, 57(23): 2891–2897.

[7] Yohannes AM, Murri MB, Hanania NA, et al., 2022, Depressive and Anxiety Symptoms in Patients With COPD: A Network Analysis. Respiratory Medicine, 198: 106865.

[8] Wiklund I, Berry P, Lu K, et al., 2010, The Chinese Translation of the COPD Assessment Test (CAT) Provides a Valid and Reliable Measurement of COPD Health Status in Chinese COPD Patients. American Thoracic Society 2010 International Conference, New Orleans, USA.

[9] Li Y, Chen L, Shi L, et al., 2013, Effects of Chronic Obstructive Pulmonary Disease Symptom Clusters on Functional Status in Elderly Patients. Guangdong Medicine, 34(21): 3319–3322.

[10] Lee AL, Harrison SL, Goldstein RS, et al., 2018, An Exploration of Pain Experiences and Their Meaning in People With Chronic Obstructive Pulmonary Disease. Physiother Theory Practice, 34(10): 765–772.

[11] Theander K, Jakobsson P, Torstensson O, et al., 2008, Severity of Fatigue Is Related to Functional Limitation and Health in Patients With Chronic Obstructive Pulmonary Disease. International Journal of Nursing Practice, 14(6): 455–462.

[12] Lim KE, Kim SR, Kim HK, et al., 2017, Symptom Clusters and Quality of Life in Subjects With COPD. Respiratory Care, 62(9): 1203–1211.

[13] Tian J, Chen X, Wang J, 2018, Correlation of the Modified British Medical Research Council Dyspnea Scale Score and Chronic Obstructive Pulmonary Disease Assessment Test Score With Pulmonary Function in Patients With Chronic Obstructive Pulmonary Disease and Their Predictive Value for Pulmonary Hypertension. Journal of Practical Heart, Brain, Lung and Vascular Disease, 26(12): 44–48.

[14] Wu R, Quan H, Wang C, et al., 2019, Applied Research on Respiratory Rehabilitation in Patients With Acute Exacerbation of Chronic Obstructive Pulmonary Disease. Industrial Hygiene and Occupational Disease, 45(6): 436–439.

[15] Zhou M, Wang G, Zhu L, et al., 2020, Research on the Effect of Early Pulmonary Rehabilitation Exercise on Patients With Acute Exacerbation of Chronic Obstructive Pulmonary Disease. Chinese Journal of Preventive Medicine, 21(04): 110–113.

[16] Wang Q, Yang B, Feng L, 2020, Research Exhibition on Early Pulmonary Rehabilitation of Patients With Acute Exacerbation of Chronic Obstructive Pulmonary Disease After Hospital Discharge. Chinese Journal of Modern Rehabilitation, 12(26): 3563–3566.

[17] Ou M, Liu Y, Guo H, et al., 2018, Research Progress on the Effect of Taijiquan on the Rehabilitation of Patients With Stable Chronic Obstructive Pulmonary Disease. Modern Clinical Nursing, 17(01): 59–64.