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Impact of Multidisciplinary Team–Based Nursing on Pulmonary and Psychological Outcomes in Acute Exacerbation of Chronic Obstructive Pulmonary Disease

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Background: We aimed to comprehensively assess the association of multidisciplinary team (MDT)-based stepped nursing intervention with dyspnea index, pulmonary function, psychological outcomes, quality of life, and nursing satisfaction in patients with acute exacerbation of chronic obstructive pulmonary disease (AECOPD).

Material/Methods: Participants (n=150) were retrospectively recruited from patients with AECOPD treated from April 2022 to December 2024 and assigned into an MDT group (n=76) and routine group (n=74) based on nursing intervention modes. Intergroup and intragroup comparisons were conducted on dyspnea index, pulmonary function indices (forced expiratory volume in 1 second [FEV_1], forced vital capacity [FVC], FEV_1/FVC, and maximum mid-expiratory flow [MMEF]), quality of life, psychological outcomes (anxiety and depression), and patient satisfaction with nursing care.

Results: Following intervention, indicators of vital capacity (FEV_1, FVC, FEV_1/FVC, MMEF) rose significantly in both groups, and were significantly higher in the MDT group ($P<0.05$). Self-Rating Anxiety Scale and Self-Rating Depression Scale scores significantly decreased in both groups following intervention; the decrease in the MDT group was significantly greater than that in the routine group ($P<0.05$). Patient satisfaction with nursing care was significantly higher in the MDT group than in the routine group ($P<0.05$).

Conclusions: The MDT-based stepped nursing intervention was associated with improvements in dyspnea severity, pulmonary function, psychological status, quality of life, and nursing satisfaction in patients with AECOPD. These findings should be interpreted as associative rather than causal, and further prospective studies with adjusted analyses and longer follow-up are warranted.

Keywords: Pulmonary Medicine • Dyspnea • Quality of Life • Chronic Obstructive Pulmonary Disease

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2327 6 — 25

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Introduction

Chronic obstructive pulmonary disease (COPD) is a common, heterogeneous chronic respiratory disease involving multiple organs, primarily caused by chronic exposure to harmful gases or particles, and characterized by persistent respiratory symptoms and airway limitation [1]. COPD is manifested as dyspnea, chest distress, and cough and can lead to death in severe cases. It is a major disease requiring prevention and treatment under the Healthy China Action (2023) [2]. Approximately 3 million people die from COPD every year worldwide, as reported by epidemiological surveys, and it is expected that the prevalence of COPD will rise over the next 40 years, making it the third major chronic disease leading to death in the world, after stroke and myocardial infarction [3]. Acute exacerbation of COPD (AECOPD) refers to a sudden-onset stage characterized by abnormalities exceeding routine levels, in which the heart and lungs are severely affected, and purulent or mucopurulent sputum is produced. AECOPD is identified as a major factor contributing to elevations in the disability and mortality rates of patients with COPD, bringing a serious chronic disease burden to patients and society [4]. Frequent exacerbations lead to recurrent hospitalizations, greatly reduce quality of life, result in rapid disease deterioration, and increase the risk of death [5]. Hence, the focus of studies on clinical nursing is on how to further effectively assist in enhancing the therapeutic effect in patients with COPD, particularly during the acute exacerbation phase.

Currently, routine nursing has been widely applied in patients with COPD, which, however, easily leads to disease relapse. Multidisciplinary team (MDT) nursing is defined as a clinical treatment mode in which, in addition to accountable nursing, a professional MDT collaborates to discuss patients' conditions, optimize diagnosis and treatment strategies, and propose diagnostic and treatment opinions [6]. Stepped nursing is a mode that targets illness severity and individualized patient needs, in which differentiated dietary management and health education measures are implemented in stages to promote patient recovery [7]. Although both MDT nursing and stepped nursing have been reported individually to improve clinical outcomes in patients with chronic respiratory diseases, evidence regarding their integrated application in patients with AECOPD remains limited. Moreover, the potential synergistic effects of combining MDT-based and stepped nursing interventions during acute exacerbations have not been systematically evaluated.

The present study was thus designed to evaluate the association of MDT-based stepped nursing with dyspnea severity, pulmonary function, psychological outcomes (anxiety and depression), quality of life, and nursing satisfaction in patients with AECOPD.

Material and Methods

Participants

A total of 150 patients with AECOPD treated in our hospital between April 2022 and December 2024 were retrospectively enrolled, and an MDT group (n=76) and a routine group (n=74) were established for assignment based on nursing intervention modes. This study was approved by the ethics committee of our hospital (EC2025-LW-006-01(K)), and informed consent was waived due to its retrospective nature. Sex, age, and course of disease were comparable between the 2 groups at baseline ($P>0.05$) (**Table 1**). Baseline characteristics, including demographic variables and disease-related clinical features, are summarized in **Table 1**.

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (1) patients who met the clinical diagnostic criteria for COPD and were diagnosed with COPD based on clinical symptoms and pulmonary function indicators [8]; (2) patients meeting the diagnostic criteria for AECOPD and with acute exacerbation of respiratory symptoms in the acute exacerbation stage [9], exceeding routine anomaly levels; (3) patients with GOLD 2 and 3 COPD; (4) patients with complete clinical data; and (5) patients with full consciousness and good cognitive function.

The exclusion criteria were as follows: (1) systemic inflammatory infectious diseases; (2) organic diseases of the liver, kidneys or lungs; (3) pulmonary arterial hypertension; (4) cardiovascular or cerebrovascular diseases; and (5) malignant tumors.

Sample Size Consideration

The sample size was determined by the number of eligible patients with AECOPD who met the inclusion criteria during the study period. This approach is consistent with previous retrospective observational studies and reflects real-world clinical practice [10].

Nursing Mode for Routine Group

Routine nursing intervention was implemented in the routine group. In brief, the vital signs of patients were regularly monitored, the doctor's advice on treatment and medication was followed, and patients were asked to maintain a regular daily routine and promptly report abnormalities (if any) for treatment.

Nursing Mode for MDT Group

The patients in the MDT group received MDT-based stepped nursing intervention. An MDT was established, consisting of

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respiratory and critical care physicians and nurses, rehabilitation therapists, psychological counselors, and nutrition consultants, to provide individualized and coordinated nursing care.

In the second stage, patients underwent comprehensive assessment based on medical history and physical examination, followed by targeted health education involving patients and their families. Education focused on AECOPD characteristics, treatment plans, daily nursing, and self-management, supported by follow-up via community visits or telephone. Psychological nursing was provided through structured communication and counseling to alleviate anxiety and depression and to promote positive coping strategies.

In the third stage, personalized dietary guidance emphasizing low-salt and low-fat intake was implemented with support from nutrition consultants. In addition, the MDT developed individualized rehabilitation programs, including respiratory training and appropriate aerobic exercise, such as chest expansion and walking, performed stepwise for 30 minutes per session, twice weekly, with exercise intensity tailored to patients' physical capacity.

Evaluation of Dyspnea Index

The dyspnea index was assessed using the modified Medical Research Council (mMRC) dyspnea scale [11], in which activity levels are classified in grades 0 to 4. The total score is 4 points, and a higher score suggests that patients are more likely to have dyspnea in the slightest activity.

Assessment of Exercise Tolerance

The maximum distance of walking on flat ground within 6 minutes was recorded, with the longer distance signifying stronger exercise tolerance of patients.

Assessment of Pulmonary Function Indicators

Pulmonary function indicators were evaluated using JQ-J pulmonary function testing equipment (Hefei Jianqiao Medical Electronic Co, Ltd, China) for the 2 groups before and after intervention, including forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC), ratio of FEV_1 to FVC (FEV_1/FVC), and maximum mid-expiratory flow (MMEF).

Evaluation of Quality of Life

Quality of life was assessed with a quality-of-life rating scale [12]. The scale is composed of 4 dimensions, namely physical health, mental health, social function, and daily function, with a maximum score of 100 points for each dimension. Higher scores indicate better quality of life.

Assessment of Negative Emotions

The Self-Rating Anxiety Scale (SAS) and Self-Rating Depression Scale (SDS) were used for the evaluation of negative emotions in patients [13]. The 2 scales include 20 items, with a total score of 80 points. An SAS score over 50 points indicates the presence of anxiety in patients, and an SDS score over 53 points indicates the presence of depression in patients. Higher SAS and SDS scores indicate a worse psychological state of patients.

Evaluation of Satisfaction With Nursing

Satisfaction with nursing was assessed using a questionnaire developed by our hospital. The total score is 100 points, with 90 or more points for very satisfied, 89 to 60 points for satisfied, and less than 60 points for dissatisfied. Overall satisfaction consisted of very satisfied and satisfied scores. The questionnaire demonstrated acceptable internal consistency (Cronbach's α=0.827).

Statistical Analysis

Statistical analysis was conducted using SPSS 26.0. Normality of continuous variables was assessed using the Shapiro-Wilk test, and homogeneity of variances was evaluated using the Levene test prior to parametric analyses. Measurement data are expressed as ($\overline{\chi}\pm s$). For between-group comparisons at the same time point, independent-samples *t* tests were applied, while within-group pre- and post-intervention comparisons were performed using paired-samples *t* tests. The sample size was determined based on the number of eligible patients during the study period. $P<0.05$ indicated a difference of statistical significance.

Results

Baseline Characteristics of Patients

Baseline demographic and clinical characteristics, including pulmonary function, dyspnea severity, exercise tolerance, and psychological status, were comparable between the MDT and routine groups (**Table 1**, all $P>0.05$).

Dyspnea Index and Exercise Tolerance

The mMRC score and exercise tolerance were comparable between the 2 groups before intervention ($P>0.05$). After intervention, a significant decrease in the mMRC score and evident increase in exercise tolerance were observed in the 2 groups, and the MDT group exhibited a significantly lower mMRC score and significantly higher exercise tolerance than the routine group ($P<0.05$) (**Table 2**).

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Table 1. Baseline characteristics of patients.

Characteristics	MDT group (n=76)	Routine group (n=74)	P
Gender n (%)			0.898
Male	48 (63.2)	45 (60.8)	
Female	28 (36.8)	29 (39.2)	
Age (years)	68.4±7.9	69.1±8.2	0.595
Course of COPD (years)	9.2±3.6	9.5±3.8	0.620
Smoking history, n (%)			0.909
Current or former smoker	52 (68.4)	49 (66.2)	
Never smoker	24 (31.6)	25 (33.8)	
GOLD stage, n (%)			0.991
GOLD 2	41 (53.9)	39 (52.7)	
GOLD 3	35 (46.1)	35 (47.3)	
Baseline mMRC score	2.6±0.7	2.5±0.8	0.416
Baseline 6MWD (m)	321.4±68.5	326.7±70.2	0.641
Baseline pulmonary function			
FEV_1 (L)	1.30±0.15	1.25±0.23	0.116
FVC (L)	1.31±0.48	1.29±0.37	0.776
FEV_1/FVC (%)	37.25±1.24	37.37±1.29	0.562
Baseline SAS score	55.6±6.8	56.1±7.2	0.663
Baseline SDS score	57.4±7.1	58.0±7.5	0.616

Data are presented as mean±standard deviation or number (%). P values represent between-group comparisons at baseline. Continuous variables were compared using the independent-samples t test, and categorical variables were compared using the χ^2 test.

Table 2. Dyspnea index and exercise tolerance ($\bar{\chi}$±s).

Group	n	mMRC score (point)		Exercise tolerance (m)	
		Before intervention	After intervention	Before intervention	After intervention
MDT	76	3.12±0.33	1.16±0.57*	174.74±53.39	245.69±59.98*
Routine	74	3.08±0.32	2.52±0.41*	173.98±54.12	191.36±58.96*
t		0.753	16.737	0.087	5.593
P^1 (within-group)		<0.001	<0.001	<0.001	0.043
P^2 (between-group)		0.452	<0.001	0.931	<0.001

Data are presented as mean±standard deviation. P^1 indicates within-group comparisons (before vs after intervention, paired t-test). P^2 indicates between-group comparisons (MDT vs routine group at the same time point, independent-samples t test). * P<0.05 vs before intervention.

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Table 3. Indicators of vital capacity ($\bar{\chi}\pm s$).

Group	n	FEV_1 (L)		FVC (L)	
		Before intervention	After intervention	Before intervention	After intervention
MDT	76	1.30±0.15	1.70±0.41*	1.31±0.48	2.25±0.31*
Routine	74	1.25±0.23	1.31±0.42*	1.29±0.37	1.94±0.48*
t		1.581	5.755	0.285	4.711
P^1 (within-group)		<0.001	0.283	<0.001	<0.001
P^2 (between-group)		0.116	<0.001	0.776	<0.001
Group	**n**	**FEV_1/FVC (%)**		**MMEF (L/s)**	
		Before intervention	**After intervention**	**Before intervention**	**After intervention**
MDT	76	37.25±1.24	43.28±2.01*	8.53±0.41	11.12±0.31
Routine	74	37.37±1.29	39.42±1.64*	8.51±0.42	10.28±0.10
t		0.581	12.868	0.295	22.210
P^1 (within-group)		<0.001	<0.001	<0.001	<0.001
P^2 (between-group)		0.562	<0.001	0.768	<0.001

Data are presented as mean±standard deviation. P^1 indicates within-group comparisons (before vs after intervention, paired t test). P^2 indicates between-group comparisons (MDT vs routine group at the same time point, independent-samples t test). * P<0.05 vs before intervention.

Table 4. Quality-of-life scores (point, $\bar{\chi}\pm s$).

Group	n	Physical health		Mental health	
		Before intervention	After intervention	Before intervention	After intervention
MDT	76	53.24±6.52	82.53±8.23*	55.36±6.42	84.75±8.58
Routine	74	53.19±6.38	74.52±7.98*	55.28±6.13	76.45±7.63
t		0.048	6.049	0.078	6.255
P^1 (within-group)		<0.001	<0.001	<0.001	<0.001
P^2 (between-group)		0.962	<0.001	0.938	<0.001
Group	**n**	**Social function**		**Daily function**	
		Before intervention	**After intervention**	**Before intervention**	**After intervention**
MDT	76	58.23±6.54	83.54±7.56*	63.94±6.72	85.53±7.89
Routine	74	58.19±6.21	75.52±7.21*	63.65±6.80	77.72±6.23
t		0.038	6.646	0.263	6.717
P^1 (within-group)		<0.001	<0.001	<0.001	<0.001
P^2 (between-group)		0.969	<0.001	0.793	<0.001

Data are presented as mean±standard deviation. P^1 indicates within-group comparisons (before vs after intervention, paired t test). P^2 indicates between-group comparisons (MDT vs routine group at the same time point, independent-samples t test). * P<0.05 vs before intervention.

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Table 5. Negative emotions (point, $\bar{\chi}\pm s$).

Group	n	SAS score		SDS score	
		Before intervention	After intervention	Before intervention	After intervention
MDT	76	52.57±4.48	38.65±3.98*	53.74±3.89	37.59±3.89*
Routine	74	52.61±4.52	45.36±3.59*	53.38±3.72	46.36±3.76*
t		0.054	10.833	0.579	14.034
P^1 (within-group)		<0.001	<0.001	<0.001	<0.001
P^2 (between-group)		0.957	<0.001	0.564	<0.001

Data are presented as mean±standard deviation. P^1 indicates within-group comparisons (before vs after intervention, paired t test). P^2 indicates between-group comparisons (MDT vs routine group at the same time point, independent-samples t test). * P<0.05 vs before intervention.

Table 6. Satisfaction with nursing [n (%)].

Group	n	Very satisfied	Satisfied	Dissatisfied	Overall satisfaction
MDT	76	45 (59.21)	26 (34.21)	5 (6.58)	71 (93.42)
Routine	74	38 (51.35)	23 (31.08)	13 (17.57)	61 (82.43)
χ^2					4.287
P					0.038

Data are presented as number (%). The χ^2 test was used to compare overall nursing satisfaction (satisfied+very satisfied vs dissatisfied) between the MDT and routine groups.

Indicators of Vital Capacity

Before intervention, no statistically significant differences were found in the indicators of vital capacity (FEV_1, FVC, FEV_1/FVC, and MMEF) between the 2 groups ($P>0.05$). After intervention, these indicators increased significantly in the 2 groups, and they were significantly higher in the MDT group than in the routine group ($P<0.05$) (**Table 3**).

Quality-of-Life Scores

The quality-of-life scores showed no statistically significant differences between the 2 groups, including scores of physical health, mental health, social function, and daily function, before intervention ($P>0.05$). Following intervention, evident increases in the scores were observed from the 2 groups, and the increase in the MDT group was significantly greater than that in the routine group ($P<0.05$) (**Table 4**).

Negative Emotions

Before intervention, the SAS and SDS scores were comparable between the 2 groups ($P>0.05$); however, they declined significantly in both groups after intervention, and the MDT group had significantly lower SAS and SDS scores than the routine group ($P<0.05$) (**Table 5**).

Satisfaction With Nursing

The satisfaction with nursing was better in the MDT group than in the routine group ($P<0.05$) (**Table 6**).

Discussion

In the present study, patients receiving MDT-based stepped nursing showed greater improvements in dyspnea severity, pulmonary function, psychological status, quality of life, and nursing satisfaction than did those receiving routine nursing care. These findings indicate a beneficial association between MDT-based stepped nursing and multidimensional clinical outcomes in patients with AECOPD. This approach is conceptually consistent with international recommendations emphasizing comprehensive, multidisciplinary supportive care as an important component of COPD management, beyond pharmacological treatment [14]. Nevertheless, given heterogeneity across clinical settings, patient populations, and study designs, these findings should be interpreted with appropriate caution.

Greater improvements in the dyspnea index and pulmonary function observed in the MDT group may be explained by the structured and coordinated nature of MDT-based stepped nursing. This model integrates individualized nursing plans,

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tailored respiratory rehabilitation, supervised implementation, and dynamic clinical assessment by physicians [15]. Similar integrated disease management strategies have been shown to improve exercise capacity and health-related quality of life in patients with COPD, supporting the biological plausibility of our findings [16,17], although residual confounding cannot be fully excluded.

In addition, stepped nursing provides stage-specific and individualized interventions aligned with disease severity and recovery phase. The integration of MDT and stepped nursing allows comprehensive support addressing the complex pathophysiology of AECOPD, which may contribute to the observed between-group differences in pulmonary function [18]. While MDT nursing has been reported to relieve dyspnea in other populations, such as in patients with cancer [19], differences in disease characteristics limit direct extrapolation to AECOPD. Nonetheless, higher quality-of-life scores in the MDT group suggest improved patient-reported outcomes, consistent with previous nurse-led and MDT-based COPD interventions [20], although the absence of formal effect size estimates limits precise quantification of clinical benefit.

Improved inhaler technique may represent an additional mechanism underlying the favorable outcomes observed in the MDT group. Incorrect inhaler use is common in COPD and is associated with poor symptom control and reduced treatment effectiveness. MDT-based stepped nursing, through repeated education, demonstration, supervision, and follow-up, may enhance correct inhaler use and medication adherence, thereby improving drug delivery and respiratory outcomes. Although inhaler technique was not directly assessed in this study, this mechanism warrants further investigation.

Stepwise nursing intervention provides step-by-step, individualized nursing services that consider disease stage and the patient's recovery process. During acute exacerbations, close monitoring of vital signs ensures airway patency and early identification of risk, while subsequent stages emphasize rehabilitation guidance and self-management education. This structure aligns with contemporary COPD management guidelines that advocate early rehabilitation and patient education following exacerbations [14]. Nevertheless, the absence of long-term follow-up precludes assessment of the sustainability of these benefits, including long-term preservation of pulmonary function or a reduction in future exacerbations.

Moreover, greater reductions in SAS and SDS scores were observed in the MDT group, suggesting an association between MDT-based stepped nursing and alleviation of anxiety and depressive symptoms. This may reflect the involvement of psychological consultants providing structured assessment and intervention, enhancing patient support, and reducing psychological distress [21,22]. Similar improvements in psychological outcomes have been reported in other MDT-based nursing studies [23]. However, heterogeneity in intervention components and outcome measures across studies should be acknowledged.

Finally, nursing satisfaction was significantly higher in the MDT group, reflecting improved patient perceptions of care quality. This may be attributed to the MDT model's ability to integrate multidisciplinary resources, reduce unnecessary referrals, shorten waiting times, and improve the overall care experience. In addition, this mode emphasizes the comprehensive assessment and timely adjustment of nursing plans according to a patient's condition, which may enhance responsiveness to patient needs and satisfaction with care [24,25].

This study has several limitations. First, its retrospective observational design and use of unadjusted analyses mean that residual confounding cannot be excluded, and the findings should therefore be interpreted as associative rather than causal. Second, effect size estimates were not calculated, limiting precise assessment of clinical relevance. Third, the lack of long-term follow-up precludes evaluation of the sustainability of the observed benefits. Finally, as a single-center study, the generalizability of the findings can be limited. Future prospective multicenter studies with adjusted analyses, effect size estimation, and longer follow-up are warranted.

Conclusions

In conclusion, MDT-based stepped nursing intervention was associated with improvements in dyspnea severity, pulmonary function, psychological status, quality of life, and nursing satisfaction in patients with AECOPD. However, these findings should be interpreted with appropriate caution. The absence of long-term outcome data and prospective validation limits the strength of recommendations for widespread clinical implementation, and further high-quality prospective studies are warranted before broader application of this nursing model can be advocated.

Consent Declarations

Informed consent was waived due to the retrospective nature of the study.

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