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Original Article

Application of Kano model-based pulmonary rehabilitation interventions in discharge preparation for patients with chronic obstructive pulmonary disease

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Abstract: Objectives: To evaluate the effectiveness of pulmonary rehabilitation interventions based on the Kano model in discharge preparation services for patients with chronic obstructive pulmonary disease (COPD). Methods: Baseline characteristics of 100 patients with COPD (Kano group=50; control group=50) were collected. Outcome indicators included forced expiratory volume in 1s (FEV_1), forced vital capacity (FVC), maximal voluntary ventilation (MVV), scores on the Readiness for Hospital Discharge Scale (RHDS), Quality of Discharge Teaching Scale (QDTS), and COPD Assessment Test (CAT). These parameters were analyzed and compared between the groups. Results: No statistical significances were observed between the two groups in baseline characteristics. After intervention, the FEV_1 and MVV values were significantly higher in the Kano group than those in the control group ($P<0.05$). The total and subscale scores of the RHDS and QDTS were significantly higher in the Kano group ($P<0.001$). In the control group, the "content actually obtained" scores were lower than the "content needed for discharge" scores ($P<0.05$), whereas in the Kano group, the "content actually obtained" scores exceeded the "content needed for discharge" scores after the intervention ($P<0.05$). CAT scores were significantly lower in the Kano group compared to the control group ($P<0.05$). Conclusions: Pulmonary rehabilitation interventions based on the Kano model significantly improve lung function, discharge readiness, quality of discharge teaching, and quality of life in patients with COPD.

Keywords: Pulmonary rehabilitation, Kano model, discharge preparation service, chronic obstructive pulmonary disease

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the leading causes of death worldwide, accounting for approximately 3.32 million deaths in 2019, with the highest burden observed in middle-income countries, according to the latest statistics from the World Health Organization [1]. Driven by the growth and aging of the global population, the prevalence of COPD is projected to rise continuously over the next four decades [2]. In China, the prevalence of COPD among individuals aged ≥40 years is approximately 13.7%, reaching 21.2% among those aged 60-69 years and 35.5% among those aged ≥70 years [3]. Due to its chronic course and recurrent exacerbations, COPD frequently leads to acute attacks, repeated hospitalizations, increased medical expenses, and even death, seriously impairing patients' quality of life [4, 5]. In 2017, COPD accounted for 95.29% of the disease burden among Chinese adults aged ≥40 years, making it a major contributor to reduced survival and disability in middle-aged and elderly people [6, 7]. COPD patients also bear a huge economic burden: average direct medical cost per COPD patient is estimated at $12,552.3, with 24.4% to 24.8% of patients at very high economic risk [8]. On average, COPD patients experience 1-2 hospital admissions per year for acute exacerbations, and 46% have at least one exacerbation annually; the frequency of their readmission increases as their condition worsens [9]. Studies abroad have also shown that up to 20% of COPD patients are readmitted within 30 days of discharge due to acute exacerbations [10]. Therefore, reducing the unplanned readmissions among elderly COPD patients is of great significance for improving the quality of life and

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alleviating the socioeconomic burden of the disease [11, 12].

Evidence suggests that discharge preparation services help ensure continuity of medical care after discharge and reduce re-hospitalization [13]. Appropriate discharge planning and timing can also enhance patient and family satisfaction with healthcare services. The 2020 Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD) report proposed pulmonary rehabilitation as the cornerstone of nonpharmacological management for stable COPD, emphasizing its role in symptom control and exacerbation prevention [14]. Numerous studies have demonstrated that pulmonary rehabilitation significantly improves the long-term quality of life of COPD patients [14-16]. However, to date, no studies have explored the integration of pulmonary rehabilitation nursing with hospital discharge preparation services.

The KANO nursing model emphasizes the differentiated effects of various nursing service attributes on patient satisfaction, categorizing needs into basic, performance, and attractive dimensions. When applied to discharge education and management, it helps clarify which services are essential, which enhance satisfaction, and which provide additional value. Previous studies have shown that it can effectively distinguish between different types of care needs among cervical cancer patients undergoing chemotherapy, providing a scientific basis for prioritizing needs and allocating resources, thereby enhancing adherence and post-discharge quality of life [17]. Building on this evidence, the present study aims to investigate the application of pulmonary rehabilitation interventions based on the Kano model in discharge preparation services for patients with COPD.

Methods

Cases

This retrospective study included 100 patients with COPD who were admitted to Lu'an People's Hospital between March 2023 and January 2024. Fifty patients who received Kano-based nursing care were assigned to the Kano group, while another 50 age-matched patients who underwent conventional treatment and nursing care served as the control group. Inclusion criteria: (1) Age over 40 years; (2) Hospitalized with a diagnosis of COPD according to the GOLD guidelines; (3) Clear consciousness with no cognitive or communication impairments. Exclusion criteria: (1) Speech, visual, or hearing impairment; (2) Recent myocardial infarction or unstable angina pectoris; (3) History of tumor or stroke; (4) Presence of severe primary diseases of the liver, kidney, or hematopoietic system, or psychiatric disorders; and (5) Recent activity limitation. The detailed patient inclusion process is illustrated in **Figure 1**. General demographic data, including age, sex, first hospitalization status, place of residence, and payment terms for hospitalization, were collected using a structured questionnaire. This study was approved by the Ethics Committee of Lu'an People's Hospital.

Evaluation strategies based on Kano model

As shown in **Table 1**, the Kano model divides healthcare service attributes into six categories, namely: (1) Must-be quality (M): Meeting this requirement does not increase satisfaction, but failing to meet it leads to dissatisfaction; (2) One-dimensional quality (O): Satisfaction increases when the requirement is fulfilled and decreases when it is not; (3) Attractive quality (A): Satisfaction markedly increases when the requirement is met but does not decrease when it is not; (4) Indifferent quality (I): Satisfaction is unaffected regardless of whether the requirement is met; (5) Reverse quality (R): The service is undesirable to the patient; and (6) Question quality (Q): Contradictory responses are given by the respondent.

Each questionnaire item included five response options: satisfied, must-be, neutral, acceptable, and unsatisfied. The Cronbach's alpha coefficient of the questionnaire was 0.725, and the validity was 0.83, both within the acceptable range of reliability and validity. Notably, must-be qualities (M) should be prioritized, followed by one-dimensional qualities (O) and attractive qualities (A), whereas reverse qualities (R) should be eliminated from the service list.

Pulmonary rehabilitation measures

The control group received routine respiratory nursing care delivered by ward nursing staff, including admission guidance, standard respiratory nursing guidance, and discharge counseling.

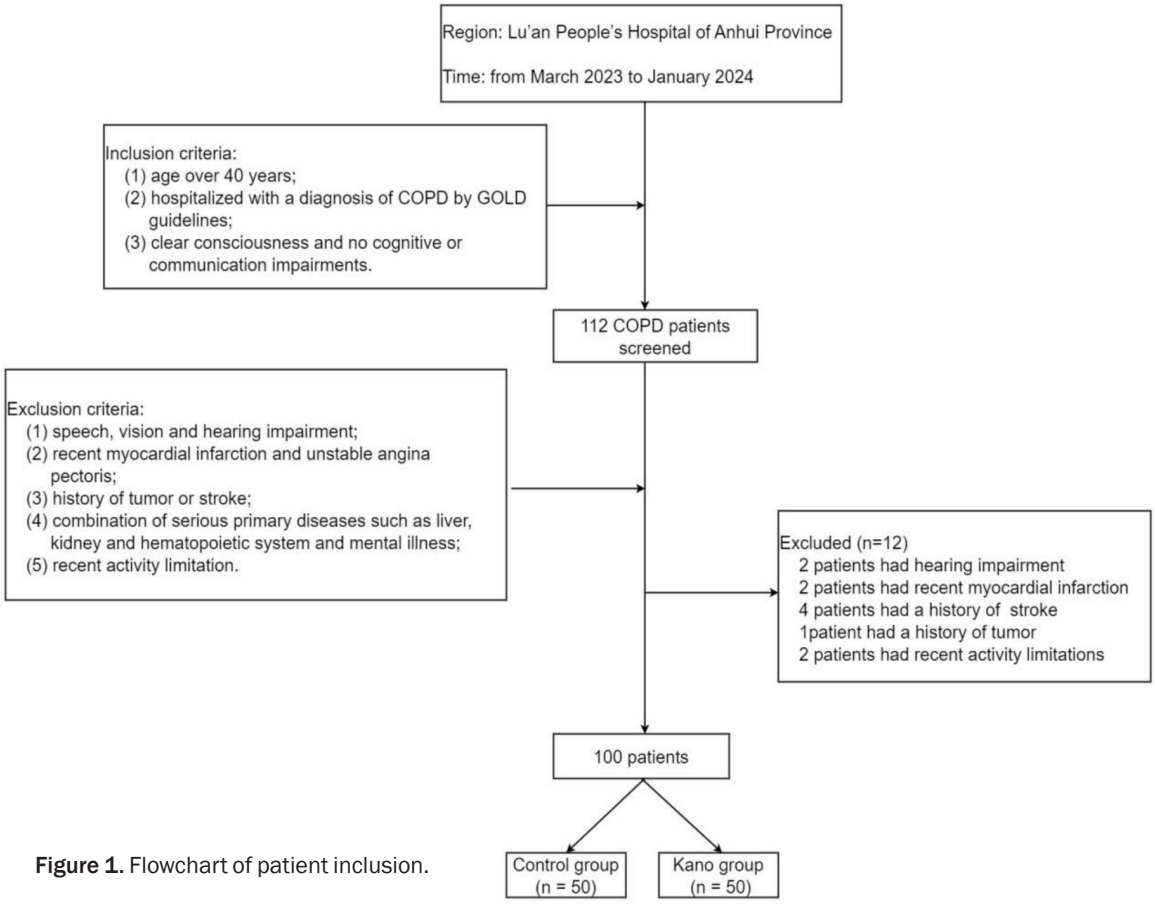

Figure 1. Flowchart of patient inclusion.

Table 1. Kano evaluation table

	Satisfied	Must-be	Neutral	Acceptable	Unsatisfied
Satisfied	Q	A	A	A	O
Must-be	R	I	I	I	M
Neutral	R	I	I	I	M
Acceptable	R	I	I	I	M
Unsatisfied	R	R	R	R	Q

Q: Questionable, A: Attractive, O: One-dimensional, R: Reverse, I: Indifferent, M: Must-be.

Kano group received pulmonary rehabilitation interventions based on the KANO model questionnaire [18], covering the following components: (1) Communication and psychological intervention: Upon admission, nurses established effective communication with patients to assess disease perception and emotional state. Psychological counseling and health education were provided to alleviate anxiety and depression, emphasizing disease controllability and the importance of rehabilitation. Family members were encouraged to participate to enhance treatment adherence; (2) Nutrition care: Individualized dietary guidance was provided according to nutritional assessments. A protein-rich diet with sufficient vitamins and trace elements was recommended, while high-salt and high-fat intake was restricted. For malnourished patients, nutritional supplementation or enteral support was arranged in collaboration with the nutrition department to ensure adequate energy and nutrient intake; (3) Expectoration care: Patients were instructed in effective airway clearance techniques, including postural drainage, chest percussion, pursed-lip breathing, and effective coughing. Nebulization or expectorant medications were used when necessary to maintain airway patency, reduce sputum retention, and minimize infection risk; (4) Respiratory exercise: A stepwise respiratory training program was implemented, including diaphragmatic breathing, pursed-lip breathing, and balloon-blowing exer-

cises. When tolerated, light aerobic activities such as walking were gradually introduced to improve ventilation and exercise endurance; We also designed an eight-step vertical breathing training program for functional training, including: ① Head movement; ② Turning movement; ③ Chest expansion movement; ④ Lateral flexion movement; ⑤ Waist rotation movement; ⑥ Rotational trunk lift movement. Each step is repeated twice, twice daily, for 10-20 minutes per session. For bedridden patients, we developed a supine bicycle training method: Lie flat on your back with arms resting alongside the body. Position legs at a 30° angle to the ground with knees flexed. Keep the upper body stationary while alternately flexing and extending both legs. Perform slow, alternating bicycle pedaling motions in the air: 12 forward strokes per session. Conduct 2-3 sessions daily, completing 10-20 sets per session. (5) Complication management: Patients were closely monitored for common complications such as respiratory failure, infection, and cardiac dysfunction. Vital signs and oxygen saturation were regularly recorded, and any abnormalities were promptly reported and managed to reduce complication rates; (6) Disease observation and environmental care: Daily records were maintained for cough, sputum volume and color, and dyspnea severity. The ward environment was kept clean, well-ventilated, and maintained at a comfortable temperature and humidity, avoiding exposure to smoke or irritants. Patients were also educated to optimize their home environment through smoking cessation and adequate ventilation.

Outcome indicators

Pulmonary function index: Pulmonary function was assessed in both groups after the intervention, including forced expiratory volume in 1 s (FEV_1), forced vital capacity (FVC) and maximal voluntary ventilation (MVV).

Readiness for Hospital Discharge Scale (RHDS): Discharge readiness reflects the degree to which a patient is physically, functionally, cognitively, and emotionally prepared to manage post-discharge health and potential complications [19]. In this study, it referred to elderly COPD patients' perceptions of their physical and psychological status at discharge, their confidence in self-managing the disease, and their expectations of family and community support after returning home. The RHDS scale consists of 3 dimensions-personal status, adaptive ability, and anticipated support-each with 4 entries, totaling 12 items. Each item is scored on a 10-point scale, with a maximum score of 120. A two-option preliminary question, 'Are you ready to be discharged from the hospital?' precedes the scale. The Cronbach's α coefficient and content validity index (CVI) of the RHDS scale were 0.89 and 0.88, respectively.

Quality of Discharge Teaching Scale (QDTS): The QDTS scale was initially developed by Weiss et al. [20] and later adapted into Chinese by Wang et al. [21]. The Chinese version was used in this study. The scale contains three dimensions, discharge information needed (six paired items), discharge information actually obtained (six paired items), and discharging teaching skills and effectiveness (12 items). The total QDTS score is the sum of scores from the second and third dimensions. Each item is rated on a 10-point scale, with a maximum score of 180. The Cronbach's α coefficient and CVI of the overall scale were 0.924 and 0.98, respectively.

COPD assessment test (CAT): The CAT was employed to evaluate patients' health-related quality of life [22]. It consists of eight items assessing symptoms such as dyspnea, cough, sputum production, fatigue, chest discomfort, sleep quality, and overall daily functioning. Each item is rated on a 5-point Likert scale (1-5), yielding a total score ranging from 0 to 40. Lower scores indicate a greater impact of COPD on the patient's quality of life.

Data acquisition

A general information questionnaire was completed for all participants. Pulmonary function indices (FEV_1, FVC, and MVV), and the RHDS, QDTS and CAT scales were administered within 48 hours of admission. Additionally, the RHDS, QDTS and CAT scales were reassessed 24 hours prior to discharge. Pulmonary function tests were also repeated at that time.

Statistical analysis

All statistical analyses were performed using SPSS26.0. RHDS, QDTS, and CAT scores were continuous variables with normal distribution

Table 2. Comparison of baseline characteristics between the two groups

Variables	Total (N=100)	Group		χ^2/t	p
		Kano group (n=50)	Control group (n=50)		
Sex, n (%)				0.258	0.615
Male	63 (63.00)	32 (64.00)	31 (62.00)		
Female	37 (37.00)	18 (36.00)	19 (38.00)		
Age year, Mean ± SD	75.37±8.69	74.80±9.25	75.94±8.24	-1.160	0.247
First hospitalization				1.478	0.193
Yes	53 (53.00)	26 (52.00)	27 (54.00)		
No	47 (47.00)	24 (48.00)	23 (46.00)		
Area of residence				1.412	0.366
Urban	80 (80.00)	41 (82.00)	39 (78.00)		
Rural	20 (20.00)	9 (18.00)	11 (22.00)		
Payment terms for hospitalization				0.922	0.428
Medical insurance	69 (69.00)	36 (72.00)	33 (66.00)		
Self-funded	31 (31.00)	14 (28.00)	17 (34.00)	0.683	0.573
Course of disease, year (n)				0.792	0.833
1-5	59 (59.00)	31 (64.00)	28 (56.00)		
>5	41 (41.00)	18 (36.00)	23 (46.00)		
Smoking history				0.439	0.226
Yes	63 (63.00)	32 (64.00)	31 (62.00)		
No	37 (37.00)	18 (36.00)	19 (38.00)		
Pulmonary function classification				2.731	0.736
I	4 (4.00)	1 (2.00)	3 (6.00)		
II	46 (46.00)	25 (50.00)	21 (42.00)		
III	45 (45.00)	23 (46.00)	22 (44.00)		
IV	5 (5.00)	1 (2.00)	4 (8.00)		
Complications				0.683	0.573
Yes	64 (64.00)	36 (72.00)	28 (56.00)		
No	36 (36.00)	14 (28.00)	22 (44.00)		

and were expressed as mean ± standard deviation (SD). Pulmonary function indices (FEV_1, FVC and MVV) did not obey a normal distribution and were presented as median (interquartile range). Categorical variables were described as frequencies and percentages.

For normally distributed data, independent-samples *t*-tests were used for between-group comparisons, paired-samples *t*-tests for within-group comparisons, and repeated-measures analysis of variance (ANOVA) for variables measured more than twice. Non-normally distributed data were analyzed using the rank-sum test. Categorical data were compared using the chi-square test or Fisher's exact test, as appropriate. A two-tailed *P* value <0.05 was considered statistically significant.

A post hoc power analysis was conducted using G*Power 3.1. Assuming a medium effect size (Cohen's d=0.5), with α=0.05 and a total sample size of 100, the calculated statistical power was 0.80, indicating adequate sample size to detect between-group differences.

Results

Baseline characteristics

A total of 100 patients were enrolled in this study, including 50 in the control group and 50 in the Kano group. There was no significant difference in sex, age, first hospitalization, region of residence, payment terms for hospitalization, course of disease, smoking history, pulmonary function classification, or complications between the two groups (P>0.05), indicating good baseline comparability (**Table 2**).

Table 3. Kano attributes classification of pulmonary rehabilitation interventions among COPD patients

Nursing Interventions	A	O	M	I	R	Q	Final Kano category
Communication and psychological intervention	5.1	27.1	15.3	52.5	0	5.1	I
Nutritional support	6.8	28.8	13.6	50.8	0	6.8	I
Expectoration care	6.8	30.5	18.6	39.0	0	5.1	I
Respiratory exercise	5.1	25.4	13.6	54.2	0	6.8	I
Complication nursing	3.4	11.8	10.2	72.9	1.7	3.4	I
Disease observation and environmental care	5.1	33.9	11.9	49.1	0	5.1	I

COPD: chronic obstructive pulmonary disease; Q: Questionable, A: Attractive, O: One-dimensional, R: Reverse, I: Indifferent, M: Must-be.

Table 4. Comparison of pulmonary function indices between the two groups before and after interventio

Time	Index	Group		statistic	p
		Kano group (n=50)	Control group (n=50)		
Pre-intervention	FVC	77 (63,92)	75 (54,84)	1.542	0.129
	FEV_1	48 (32,66)	42 (29,60)	2.354	0.673
	FEV_1/FVC	49 (40,59)	49 (40,61)	2.106	0.148
	MVV	43 (35,70)	41 (28,63)	1.652	0.836
Post-intervention	FVC	76 (63,90)	71 (55,84)	0.669	0.090
	FEV_1	52 (34,66)	43 (26,58)	1.160	0.035
	FEV_1/FVC	51 (41,61)	49 (38,61)	1.968	0.573
	MVV	53 (35,65)	40 (29,60)	1.412	0.046

FEV_1: forced expiratory volume in 1s, FVC: forced vital capacity, MVV: maximal voluntary ventilation.

Table 5. Comparison of RHDS and QDTS scores between the two groups within 48 hours of admission

Scale	Dimension	Kano group (n=50)	Control group (n=50)	*t*	*P*
RHDS	Personal status	27.22±1.08	27.27±1.07	0.239	0.752
	Adaptive capacity	15.45±1.85	15.99±1.70	0.181	0.632
	Expected support	17.98±1.75	16.69±1.16	0.622	0.846
	Total scores	60.66±1.59	59.96±1.32	0.804	0.531
QDTS	Content needed	40.06±2.17	40.52±2.52	-0.220	0.529
	Content actually obtained	26.37±2.65	26.07±1.99	0.522	0.654
	Teaching skills and effectiveness	71.41±2.57	70.89±2.41	0.779	0.466
	Total scores	98.18±2.65	97.83±2.42	0.487	0.268

RHDS: Readiness for Hospital Discharge Scale, QDTS: Quality of Discharge Teaching Scale.

Kano attributes classification of pulmonary rehabilitation interventions among COPD patients

As shown in **Table 3**, there were no significant differences in patients' willingness toward the various pulmonary rehabilitation interventions, suggesting that participants showed neither particular satisfaction nor dissatisfaction with these nursing interventions prior to implementation.

Pulmonary function indices

Before intervention, there were no significant differences between the two groups in terms of pulmonary function indices (P>0.05). After intervention, the FEV_1 (34.66% vs 26.58%) and MVV (35.65% vs 29.60%) were significantly higher in the Kano group than those in the control group (P<0.05). No significant differences were found in FVC or FEV_1/FVC between the two groups after intervention (P>0.05) (**Table 4**).

Table 6. Comparison of RHDS and QDTS scores between the two groups before discharge

Scale	Dimension	Kano group (n=50)	Control group (n=50)	*t*	*P*
RHDS	Personal status	36.56±1.64	34.44±1.79	5.239	<0.001
	Adaptive capacity	22.74±1.56	19.68±1.32	5.452	<0.001
	Expected support	33.26±2.09	28.95±1.88	8.651	<0.001
	Total scores	92.47±1.84	83.02±1.67	16.463	<0.001
QDTS	Content needed	40.52±2.07	40.44±2.72	0.166	0.869
	Content actually obtained	41.58±2.09	35.87±1.65	1.522	0.013
	Teaching skills and effectiveness	89.92±2.45	87.03±2.69	5.735	<0.001
	Total scores	136.02±2.98	132.42±2.83	7.462	<0.001

RHDS: Readiness for Hospital Discharge Scale, QDTS: Quality of Discharge Teaching Scale.

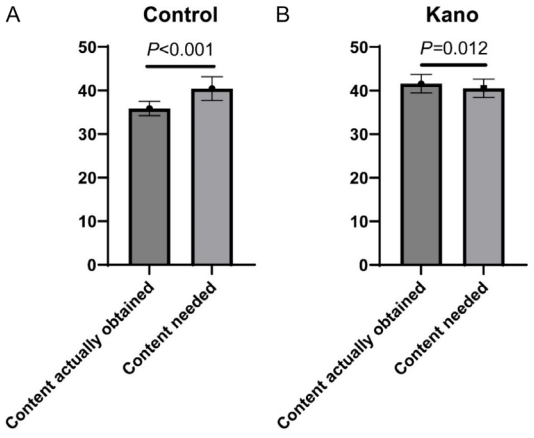

Figure 2. Comparison of scores of content needed and content actually obtained between the two groups before discharge. A: Control group. B: Kano group.

RHDS and QDTS scores

The total and dimensional scores of the RHDS and QDTS followed a normal distribution. Statistical analysis showed no significant differences in total or subscale scores between the two groups before intervention (P>0.05) (**Table 5**).

After the intervention, the total RHDS score was significantly higher in the Kano group than that in the control group (92.47±1.84 vs. 83.02±1.67, P<0.05). Similarly, the total QDTS score of the Kano group (89.92±2.45) was significantly higher than that of the control group (87.03±2.69) (P<0.05) (**Table 6**).

The needed and obtained content scores

Both groups were compared regarding the "content needed for discharge" and "content actually obtained" dimensions. The differences between the two dimensions followed a normal distribution. In the control group, the score for content actually obtained was significantly lower than that for content needed for discharge (35.87±1.65 vs. 40.52±2.72, *P*<0.05). Conversely, in the Kano group, the score for content actually obtained exceeded that for content needed for discharge (41.58±2.09 vs. 40.52±2.07, *P*<0.05) (**Figure 2**).

Comparison of CAT scores

At admission, CAT scores were comparable (P>0.05). By discharge, the Kano group showed significantly lower CAT scores than the control group (P<0.05). Within-group comparisons also showed significant score reductions in both groups (P<0.05) (**Table 7**).

Discussion

Previous studies have shown that discharge preparation services help ensure continuity of care after hospital discharge, reduce the risk of re-hospitalization or premature discharge, and improve patients and family satisfaction with health-care services [23]. This study demonstrated that COPD patients who received pulmonary rehabilitation interventions based on the Kano model achieved significantly higher RHDS and QDTS scores, as well as improved FEV_1 and MVV values compared with the control group.

Pulmonary function tests provide objective measures of airflow limitation and are considered the 'gold standard' for the diagnosis of COPD. They are widely used to evaluate disease severity, monitor disease progression, and assess prognosis and therapeutic response. Specifically, FVC reflects airway resis-

Table 7. Comparison of CAT scores

	Kano group (n=50)	Control group (n=50)	*t*	*P*
Admission	21.12±2.08	21.29±2.13	0.404	0.687
Discharge	16.42±1.97	18.87±2.15	5.941	<0.001
t_1	11.601	5.654		
P_1	<0.001	<0.001		

CAT: COPD assessment test.

tance, while FEV_1% is often used to determine the severity of airflow limitation. A post-bronchodilator FEV_1/FVC ratio <70% indicates persistent airflow obstruction [24]. MVV primarily reflects the overall ventilatory reserve capacity of the lungs. Previous research indicates that combining empowerment-based continuous care with pulmonary rehabilitation can improve lung function and alleviate anxiety and depression in COPD patients [25]. In this study, post-intervention FEV_1 was significantly higher in the Kano group than in the control group, consistent with the findings of Andrello et al. [26]. The observed improvement in FEV_1 may be explained by two key mechanisms. First, airway inflammation is a hallmark pathological feature of COPD. Elevated inflammatory cytokines exacerbate the inflammatory responses, contributing to progressive decline in lung function [27]. Previous studies have demonstrated a negative correlation between inflammatory markers and lung function indices, including FEV_1 and FEV_1/FVC [28]. Respiratory training alleviates dyspnea and enhances ventilation efficiency. Techniques such as pursed-lip breathing increase airway pressure, prevent premature small airway collapse, promote alveolar gas exchange, and reduce lung hyperinflation. These mechanisms may explain the improvement in FEV_1 observed in the present study. However, the absence of a significant change in FEV_1/FVC further supports the understanding that airflow limitation in COPD remains largely irreversible [29]. The magnitude of MVV reflects respiratory muscle strength and airway resistance. Long-term inhalation therapy can alleviate dyspnea and partially reduce airway resistance, thereby improving MVV in COPD patients. Previous studies have demonstrated that MVV is closely correlated with the prognosis of COPD, and both MVV and FEV_1 possess strong predictive value for functional exercise capacity and patient-reported outcomes [26]. Additionally, the CAT score was used to further evaluate the impact of the intervention on patients' health-related quality of life. A significantly greater reduction in CAT scores was observed in the Kano group prior to discharge, indicating that the Kano-based intervention effectively alleviated subjective symptoms and enhanced overall quality of life. As a widely recognized tool in COPD management, the CAT scale captures multidimensional improvements in cough, dyspnea, physical activity, and energy levels, thereby reflecting the multidimensional benefits of rehabilitation. The observed improvements in MVV and CAT scores may be related to enhanced respiratory muscle function and reduced airway resistance through pulmonary rehabilitation and long-term medication use [30]. These interventions can strengthen ventilatory reserve, alleviate dyspnea, and promote better adherence to treatment. In addition, individualized discharge guidance based on the Kano model may increase patients' self-efficacy and participation in rehabilitation, which in turn contributes to both objective and subjective improvements in lung function and quality of life [31].

The concept of discharge readiness was first defined as the extent to which a patient perceives themselves as prepared to transition from hospital to home and to adapt to changes in health status [32]. Evaluating discharge readiness before a patient leaves the hospital enables healthcare professionals to understand the patient's perceptions and psychological state, allowing further adjustments to the discharge care plan to better meet the patient's needs. This process is crucial for a successful transition from hospital to home [33]. A Previous research conducted abroad has shown that disease adaptability, that is, the patient's acceptance of illness, is significantly related to age; as age increases, both adaptability and acceptance tend to decline [34].

Elderly patients often experience multiple comorbidities and age-related physiological decline, which, coupled with limited disease-related knowledge-such as medication management-results in poor adaptability after discharge [35]. In this study, the total RHDS score and all subscale scores in the intervention group were significantly higher than those in

the control group at discharge, indicating that the Kano model-based pulmonary rehabilitation intervention effectively improved discharge readiness among elderly COPD patients. These findings are consistent with those reported by Wu et al. [36]. Within-group comparison of the "content actually obtained" and "content needed for discharge" dimensions revealed that, in the control group, the difference between these scores was negative, suggesting that discharge education did not meet patients' needs. In contrast, the difference was positive in the intervention group, indicating that patients in this group received discharge guidance that adequately met their informational and educational needs. Furthermore, both the discharge teaching skills scores and overall QDTS scores were higher in the intervention group than in the control group, demonstrating that the Kano model-based discharge preparation intervention improved the quality of discharge guidance for elderly COPD patients. These findings are consistent with previous research showing that individualized and structured discharge planning significantly enhances patient readiness and continuity of care, particularly among elderly patients with chronic diseases [37].

It is noteworthy that this study has several limitations. First, only short-term outcomes at discharge were evaluated, and long-term follow-up data were lacking. Therefore, the sustained effects of the intervention could not be fully determined, which limits the conclusiveness of our findings regarding its long-term benefits. Future studies with larger sample sizes, more rigorous designs, and extended follow-up periods are needed to further validate the stability and durability of the observed results. Second, COPD is a chronic condition characterized by a long disease course, and frequent exacerbations requiring repeated hospitalizations. Although we recorded whether patients were first-time admissions and ensured compatible baseline characteristics between groups, no further stratifications or subgroup analysis was performed for patients with repeated hospitalizations, which may have introduced potential bias. Third, this study did not directly compare the Kano model-based intervention with other established discharge preparation strategies for COPD, which limits the ability to determine its relative superiority. Future studies should incorporate comparative analyses to clarify its advantages and cost-effectiveness in clinical practice.

Conclusion

Kano model-based pulmonary rehabilitation interventions significantly improve lung function and discharge readiness in patients with COPD compared with conventional care. These findings suggest that the Kano model holds promising potential for broader application in discharge preparation services for COPD management.

Disclosure of conflict of interest

None.

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