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ORIGINAL RESEARCH

COPD-ES Questionnaire Based COPD Patients Management in Stable Phrase Improves Disease Group Classification

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Introduction: Chronic obstructive pulmonary disease (COPD) is a prevalent, incurable condition requiring lifelong management. Inadequate daily management exacerbates COPD, leading to increased healthcare utilization and reduced quality of life.

Methods: This study aimed to design and validate a 10-item COPD self-evaluation (COPD-ES) questionnaire and apply it in the education of stable COPD patients. Participants were recruited from the Third Xiangya Hospital of Central South University and randomly assigned to control and intervention groups. The intervention group received monthly disease education using the COPD-ES questionnaire during a 6 months observation period.

Results: Significant improvements in smoking cessation, medication adherence, and disease knowledge in the intervention group were found. The intervention also led to a reduction in COPD Assessment Test (CAT) scores, modified Medical Research Council (mMRC) grades and acute exacerbation frequency. The COPD group classification improved accordingly.

Conclusion: The study highlights the importance of patient-centered education with our COPD-ES questionnaire in improving COPD management outcomes.

Keywords: COPD, management, questionnaire

Introduction

Chronic obstructive pulmonary disease (COPD) is one of the most common lung diseases worldwide. Despite advancements in modern medicine, COPD remains an irreversible and incurable disease. Once diagnosed, patients require lifelong treatment and daily management.[1] However, COPD remains a treatable disease if proper medications and self-managements are conducted in time. Inadequate daily management directly results in higher acute exacerbation frequency. For COPD patients, disease exacerbation not only leads to increased emergency visits, hospitalizations, and healthcare costs but also signifies a sharp decline in quality of life and a significantly higher risk of mortality.[2,3]

The high prevalence and mortality of COPD, coupled with poor daily management, are linked to insufficient public awareness. Surveys in Spain in 2002 and 2011 showed only a slight improvement in COPD knowledge, with an awareness rate still low at 17.0%.[4,5] Insufficient knowledge about COPD of COPD patients leads to delayed disease self-recognition in early stage and eventually leads to delayed diagnosis, disease progression, and worsening condition. A study demonstrated that providing COPD patients with a comprehensive patient education program led by healthcare professionals can significantly reduce healthcare utilization and improve health outcomes.[6] Therefore, more attention shall be paid to the disease management plans and prioritize patient-centered education.

However, due to heterogeneity in intervention methods, study populations, follow-up durations, and outcome measures, current research on disease education for COPD patients has shown varied and inconsistent results.[7] Consequently, it remains challenging for healthcare professionals to provide clear and concise recommendations regarding the form and content of COPD education programs. Therefore, this study aims to design and validate a COPD self-evaluation (COPD-ES) questionnaire and apply it in the disease education of patients with stable COPD. We intend to explore the impact of self-management based on questionnaire responses and explanations on patients with stable COPD, focusing on disease awareness, self-management, and symptom control.

Methods
Participant Enrollment Screening Process

From October 2022 to June 2023, stable COPD patients were recruited from the outpatient department of the Third Xiangya Hospital of Central South University in a random recruitment manner. Inclusion criteria: a. Age $\geq$ 40 years; b. Diagnosed with COPD based on the 2022 GOLD guidelines (post-bronchodilator FEV1/FVC <0.7) and in a stable phase of the disease (patients experience a manageable level of symptoms (eg, dyspnea, cough, and sputum production) without acute exacerbations or sudden deterioration); c. The ones who are literate, can read and communicate normally, and can effectively use phone or other online communication tools. Exclusion criteria: a. Patients with psychiatric or cognitive impairments, or physical disabilities; b. Patients with severe pulmonary diseases (eg, interstitial lung disease, lung cancer); c. Patients with severe medical or surgical conditions affecting study participation (eg, chronic heart failure, uremia); d. Patients involved in other remote monitoring projects (Figure 1A). The group classification strategy is based on the 2023 GOLD guidelines (the A and B groups are unchanged, but the C and D groups are now merged into a single group termed "E" to highlight the clinical relevance of exacerbations). This study was approved by the Institutional Review Board of The Third Xiangya Hospital of Central South University (approve no. K-I22221). Each participant signed an informed consent. The present study complies with the Declaration of Helsinki.
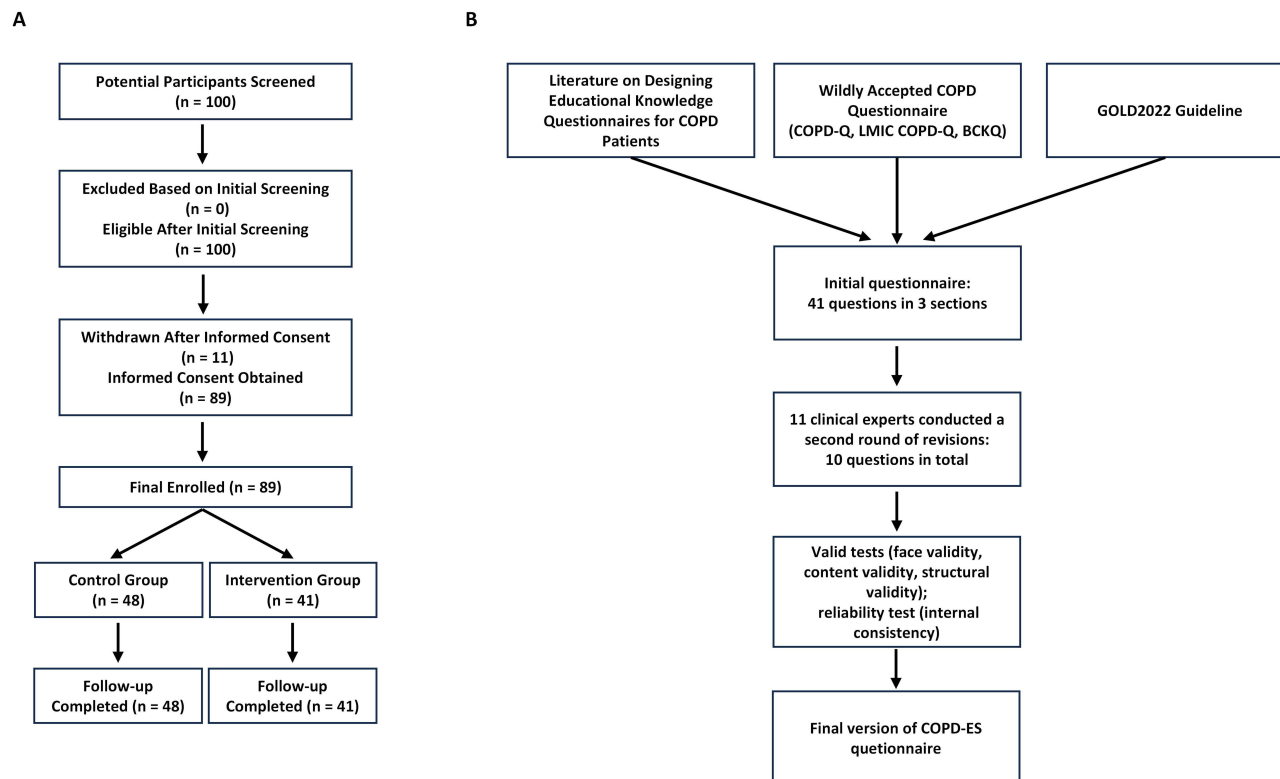

Figure 1 Patient enrollment and questionnaire item screening flowchart. (**A**) Patient enrollment strategy follows this flowchart. (**B**) The final version of COPD-ES questionnaire selection method.

Intervention Methods for Participants

Participants were randomly assigned to the control group (n=48) and intervention group (n=41) using a single-blind simple randomization method. During follow-up, both control and intervention groups received standard treatments per the 2022 GOLD guidelines, including medication, smoking cessation support, respiratory care, and regular outpatient visits. However, disease education using the COPD-ES questionnaire was provided only to the intervention group. Baseline demographic and disease information was collected from all patients during their initial outpatient visit. For participants in the control group, comprehensive observation and symptom assessment were conducted on Days 1 and 180 of the study. In the intervention group, the COPD-ES questionnaire was administered three times—on Days 1, 90, and 180—with comprehensive observation and symptom assessment conducted prior to each evaluation.

Intervention measures: a. Monthly completion of the COPD-ES questionnaire at a fixed time, scored by clinical professionals, with explanations of questionnaire content and answering patient queries. b. Assessment of COPD Assessment Test (CAT) scores and modified Medical Research Council (mMRC) grading at days 1 and 90, with follow-up evaluation at days 180 including CAT scores, mMRC grading, acute exacerbation counts, and disease group reclassification.

Generation Strategy of the COPD-ES Questionnaire

Validated COPD-related knowledge questionnaires were collected according to literatures,[8–10] and content from existing questionnaires was selected through collective discussion among all authors involved in this study, referring to the key self-management strategies for stable COPD patients outlined in the 2022 GOLD guidelines, resulting in three sections comprising a total of 41 questions (initial version of COPD-ES questionnaire). This version of COPD-ES questionnaire was developed by some of the listed authors in this study (Miss Yi Yang, Dr. Shengyang He and Prof. Lihua Xie).

Eleven experts in pulmonology area were invited to evaluate this initial version of COPD-ES questionnaire. The evaluation methods were described previously.[11] Briefly, Experts will assess item quality using a Likert-5 scale, providing feedback for revisions based on ratings: 5 for very important, 4 for important, 3 for moderate, 2 for unimportant, and 1 for very unimportant. Items with an average importance score >3.5, coefficient of variation <0.25, and maximum score proportion of >20% will be selected (Figure 1B).

Questionnaire Rationality Validation Strategy

The questionnaire rationality validation strategy was described previously. Briefly, rationality validation includes validity[12,13] and reliability tests.[14] Validity testing involves surface validity, content validity (assessed by CVR, I-CVI, and S-CVI/Ave, if I-CVI >0.780 and S-CVI/Ave ≥0.800, indicating good content validity for the questionnaire), and structural validity (evaluated using methods like EFA and CFA). For EFA, a KMO value of >0.6 and Bartlett's test significance of <0.05 are required. Good structural validity is indicated if each item loads >0.4 on a common factor and the cumulative variance contribution is >40%. Internal consistency reliability, assessed by Cronbach's alpha coefficient (Cronbach's α), is a widely used method to evaluate measurement reliability. An α > 0.8 indicates excellent internal consistency, while α values between 0.6 and 0.8 indicate good consistency. Values below α < 0.6 suggest relatively poor internal consistency (Abbreviations: CVR, Content Validity Ratio; I-CVI, Item-level Content Validity Index; S-CVI/Ave, Scale-level Content Validity Index, Average).

Statistical Analyses

We utilized SPSS 27.0 for statistical analysis. Given sample sizes <50 in both groups, data normality was assessed using the Shapiro–Wilk test. Categorical data were analyzed using independent samples *t*-tests, while continuous data were subjected to chi-square tests, Wilcoxon signed-rank tests, and Mann–Whitney tests for statistical analysis.

Results
The Final Version of COPD-ES Questionnaire Items and Related Reliability and Validity Testing

As described in the methods section above, the final version of the COPD-ES questionnaire is presented in Table 1, consisting of 10 items. Each item's importance score was evaluated by 11 clinical experts, with 8 items receiving full

Table 1 The Final Version of COPD-ES Questionnaire and Related Reliability and Validity Testing

Items	Importance Scorings	Coefficient of Variation	I-CVI	S-CVI/Ave	CVR	KMO Value	Bartlett's Sphericity test	Cronbach's Alpha Coefficient
1.Which of the following are risk factors for COPD?	4.73	0.14	1.00	1.00	1.0	0.552	103.597	0.660
2.In which season is COPD most commonly diagnosed?	5.00	0	1.00	1.00				
3.What are the main symptoms of COPD?	5.00	0	1.00	1.00				
4.What are the main clinical symptoms during a COPD exacerbation?	5.00	0	1.00	1.00				
5.Which of the following tests is used to diagnose COPD?	5.00	0	1.00	1.00				
6.Is long-term medication therapy necessary for COPD?	5.00	0	1.00	1.00				
7.What is the primary medication for treating COPD?	5.00	0	1.00	1.00				
8.What is the main approach to medication during the stable phase of COPD?	5.00	0	1.00	1.00				
9.Does quitting smoking help improve symptoms associated with COPD?	5.00	0	1.00	1.00				
10.Is annual pneumonia vaccination recommended for COPD patients?	4.82	0.13	1.00	1.00				

scores and the remaining 2 scoring 4.73 and 4.82, respectively. The coefficient of variation for 8 items was 0, while for the other 2 items it was 0.14 and 0.13. Following face validity and content validity testing, all 10 items demonstrated an I-CVI and S-CVI/Ave of 1.00, and the questionnaire's CVR was 1.00. Structural validity testing indicated a KMO value of 0.552 and Bartlett's sphericity test of 103.597 ($p<0.001$). Reliability testing revealed a Cronbach's alpha coefficient of 0.660, indicating strong internal consistency among all questionnaire items.

Basic Information of the Participants

Table 2 summarizes demographic and clinical characteristics of participants in the control (n=48) and intervention (n=41) groups. Age distribution was similar between groups (control: 63.83 ± 7.078 years; intervention: 62.51 ± 7.036 years; p = 0.381). Gender distribution and lung function severity (GOLD classification) did not significantly differ between groups (p > 0.05). Smoking status, home oxygen therapy use, and participation in pulmonary rehabilitation therapy were also comparable (p > 0.05). Notably, influenza vaccination rates differed significantly between groups (p < 0.001).

Table 2 Basic Demographic and Disease Characteristics of Enrolled Patients

	Control Group (N=48)	Intervention Group (N=41)	$t/X^2/Z$	p value
Age	63.83±7.078	62.51±7.036	0.880	0.381
Gender			0.000	1.000
Male	47(97.9)	40(97.6)		
Female	1(2.1%)	1(2.4%)		
Lung Function			0.773	0.442

(*Continued*)

Table 2 (Continued).

	Control Group (N=48)	Intervention Group (N=41)	t/X²/Z	p value
GOLD 1	0	0		
GOLD 2	30(62.5%)	27(65.9%)		
GOLD 3	17(35.4%)	14(34.1%)		
GOLD 4	1(2.1%)	0		
Smoking	29(60.4%)	29(70.7%)	1.036	0.309
Pack-Years of smokers	28.83±6.012	30.21±8.811	0.812	0.329
Home oxygen therapy	13(27.1%)	13(31.7%)	0.229	0.633
Pulmonary rehabilitation therapy	3(6.3%)	0	1.080	0.299
Influenza vaccination	4(8.3%)	0	89.000	<0.001
Cardiovascular Diseases	15	16		
Metabolic Disorders	8	10		
Respiratory Diseases	5	2		
Neurological and Psychological Disorders	5	3		
Gastrointestinal Disorders	2	2		

The Impacts of the COPD-ES Questionnaire Intervention on Smoking Habits and Medication Use Among Participants

After 6 months of intervention, the intervention group's questionnaire scores were significantly higher than those of the control group (Figure 2A). Specifically, questionnaire scores in the intervention group were significantly higher than baseline at 3 months, and still went up at 6 months (Figure 2B). Initially, both groups showed similar smoking prevalence (60% at 0M). By 6 months, smoking rates remained unchanged in the control group (60%) but significantly decreased in the intervention group to 22% (Table 3). Medication adherence improved notably in the intervention group, with 100% reporting appropriate use at 6 months, compared to 12% initially (Table 3). These findings underscore the intervention's effectiveness in reducing smoking rates and enhancing medication compliance in COPD patients.

COPD-ES Questionnaire Intervention Improves COPD Patients' Group Classification

Baseline CAT scores did not differ significantly between the control and intervention groups (P=0.908). After 6 months, the intervention group's CAT score (15.49 ± 4.734) was significantly lower than the control group's (18.81 ± 5.330) (P=0.007) (Figure 2C). Specifically, the intervention group's CAT score decreased from 19.27 ± 5.040 at baseline to 15.88 ± 5.231 at 3 months and 15.49 ± 4.734 at 6 months, with a non-significant change of 0.39 points between 3 months and 6 months (P=0.295) (Figure 2D).

At baseline, the control group had mMRC grades 1–3 proportions of 42%, 31%, and 27%, respectively, excluding grades 0 and 4. After 6 months, these proportions changed to 46%, 31%, and 19% for grades 1–3, with 2% each for grades 0 and 4. No statistical significance was observed (p=0.442). In the intervention group at baseline, proportions for grades 0–3 were 15%, 56%, 24%, and 5%. After 3 months, there was a significant decrease in grades 1 and 2 patients, with an increase in grade 0 patients to 18 individuals. Specifically, grade 1 decreased to 20 patients, and grade 2 decreased to 3 patients (p<0.001). There were no significant changes in mMRC grade proportions between 3 and 6 months in intervention group (Figure 2E).

Table 4 summarizes acute exacerbation incidence during follow-up by group. In the control group, frequencies were 18 (0 exacerbations), 17 (1), 7 (2), 3 (3), and 3 (>3). In the intervention group, frequencies were 26 (0), 10 (1), 5 (2), and none for 3 or more exacerbations. A significant difference was found (Z = 2.613, p = 0.009).

In the control group at baseline, there were 0 participants in Group A, 37 in Group B, and 11 in Group E; at 6 months, these numbers changed to 0, 31, and 17, respectively (Z = 2.449, p = 0.014). In the Interventional group at 0M, there were 0 participants in Group A, 34 in Group B, and 7 in Group E; at 6M, these numbers were 2, 35, and 4, respectively
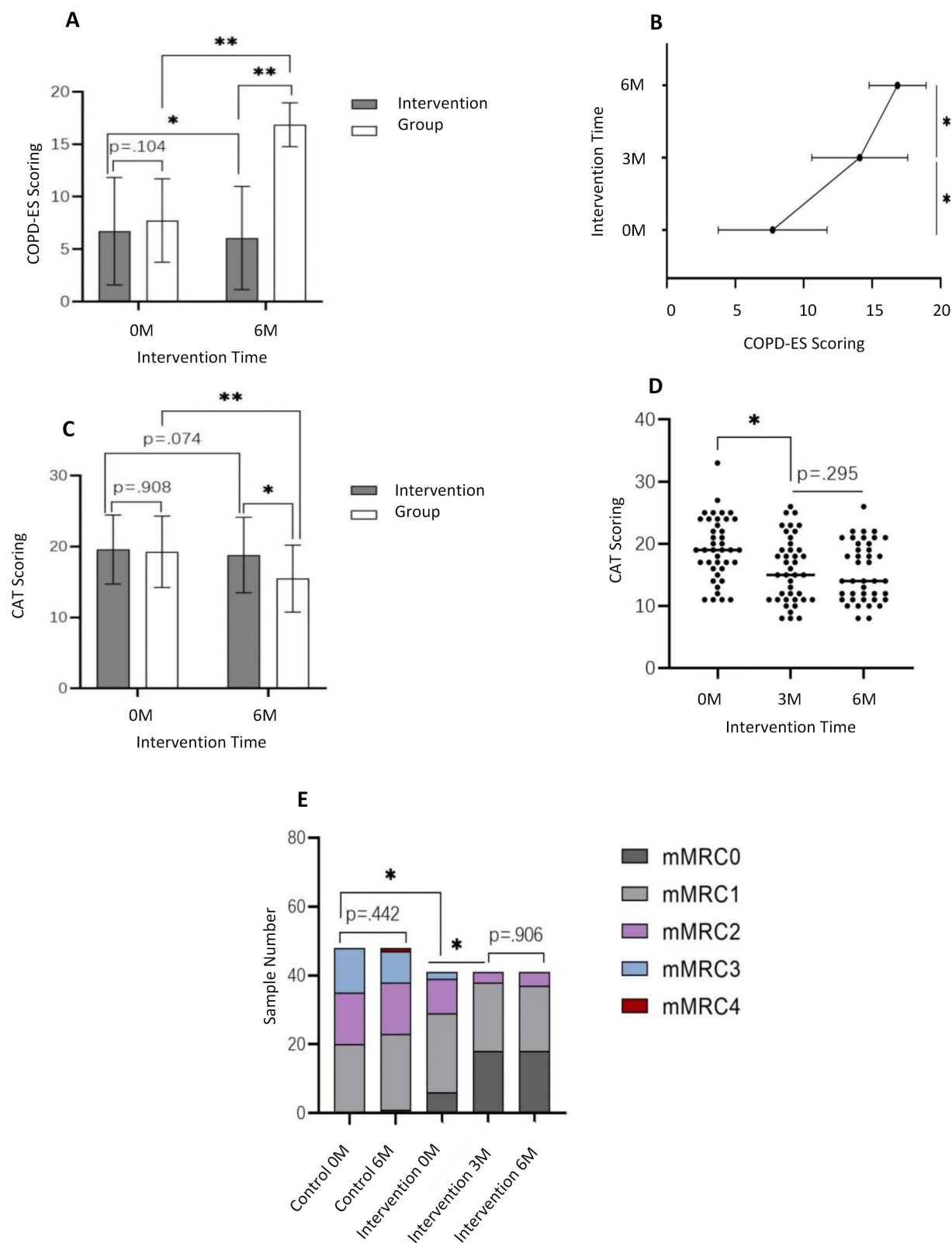
Figure 2 COPD-ES questionnaire-based management method improve disease knowledge, CAT score and mMRC grading of COPD patients in stable phrase.After 6 months of COPD-ES questionnaire-based intervention, the questionnaire scores significantly increased in the intervention group compared to the control group (**A**), showing a time-dependent manner (**B**). The CAT scores in the intervention group followed a similar trend (**C**), with no significant differences between the 3rd and 6th months (**D**). No significant changes in mMRC grading were observed in the control group during the follow-up. While the intervention group showed notable improvement after 6 months. However direct comparison between the two groups is not possible due to different baseline mMRC grading distributions (**E**). *p<0.05; **p<0.01.

Table 3 Changes in Smoking and Medication Habits Post-Intervention by COPD-ES Questionnaire

	Control Group		Interventional Group	
	0M	6M	0M	6M
Smoking number	29 (60%)	29 (60%)	29 (71%)	9 (22%)
Appropriate medication use	7 (15%)	19 (40%)	5 (12%)	41 (100%)

Table 4 The Incidence of Acute Exacerbations During the Follow-Up Period

Group	The Number of Acute Exacerbations During the Follow-Up Period				
	0	1	2	3	>3
Control	18	17	7	3	3
Intervention	26	10	5	0	0
Z Value	2.613				
P value	0.009				

$(Z = 2.236, p = 0.025)$. Significant changes were observed within both groups over the intervention period (Table 5). Also, we analyzed the distribution of correct and incorrect questionnaire responses for both patient groups at each stage (Table 6 and Table 7).

Discussion

In this study, we designed a concise COPD-ES questionnaire based on the Knowledge-Attitude-Practice (KAP) Theory,[15] to promote self-management among stable COPD patients. After reviewing validated questionnaires, incorporating evaluations from 11 experts, and performing statistical analyses, we finalized a 10-item questionnaire. This streamlined version is easier for patients to complete, saving time and improving assessment accuracy. Monthly interventions based on the COPD-ES questionnaire improved smoking cessation, medication adherence, and disease group reclassification.

Currently available questionnaires related to COPD cover multiple dimensions, including early disease screening, disease knowledge, symptom assessment, pulmonary rehabilitation, nutritional screening, and psychological evaluation of patients. Among these, commonly used questionnaires for assessing COPD-related knowledge include the LMIC COPD-KQ,[9] the COPD-Q,[8] and the BCKQ.[10] However, these questionnaires contain dozens of items which make the whole evaluation process extremely complicated and time-consuming. From the perspective of questionnaire quality assessment, these validated COPD-related knowledge questionnaires have good reliability and validity, with Cronbach's alpha coefficients of 0.75 for COPD-Q, 0.73 for The LMIC COPD-KQ, and 0.75 for BCKQ.[8-10] The COPD-ES questionnaire has an overall Cronbach's alpha of 0.66, demonstrating good internal consistency. The CVR, I-CVI, and S-CVI/Ave are all 1.00, indicating excellent content validity. The KMO value of 0.552 suggests low inter-item

Table 5 Disease Classification Changes Post-Intervention by COPD-ES Questionnaire

Group	0M			6M			Z Value	P value
	A	B	E	A	B	E		
Control	0	37	11	0	31	17	2.449	0.014
Interventional	0	34	7	2	35	4	2.236	0.025
Z Value	0.680			3.066				
P value	0.496			0.002				

Table 6 Answer Distribution in Control Group

Items	Correct in Control (P: Partially Correct, A: Completely Correct)		Wrong in Control		Not Answered in Control	
	0M	6M	0M	6M	0M	6M
1.Which of the following are risk factors for COPD?	P12 (25%) C4 (8.3%)	P 12(25%) C 5(10.4%)	32(66.7%)	31(64.6%)	0	0
2.In which season is COPD most commonly diagnosed?	26 (54.2%)	22(45.8%)	22(45.8%)	26(54.2%)	0	0
3.What are the main symptoms of COPD?	P11 (22.9%) C8 (16.7%)	P 12(25%) C 4(8.3%)	29(60.4%)	32(66.7%)	0	0
4.What are the main clinical symptoms during a COPD exacerbation?	P15 (31.2%) C4 (8.3%)	P 9(18.8%) C 2(4.2%)	29(60.5%)	37(77%)	0	0
5.Which of the following tests is used to diagnose COPD?	9 (18.8%)	6(12.5%)	39(81.2%)	42(87.5%)	0	0
6.Is long-term medication therapy necessary for COPD?	23 (47.9%)	20(41.7%)	25(52.1%)	28(58.3%)	0	0
7.What is the primary medication for treating COPD?	21 (43.7%)	16(33.3%)	27(56.3%)	32(66.7%)	0	0
8.What is the main approach to medication during the stable phase of COPD?	17 (35.4%)	14(29.2%)	31(64.6%)	34(70.8%)	0	0
9.Does quitting smoking help improve symptoms associated with COPD?	34 (70.8%)	34(70.8%)	14(29.2%)	14(29.2%)	0	0
10.Is annual pneumonia vaccination recommended for COPD patients?	8 (16.7%)	6 (12.5%)	40(83.3%)	42(87.5%)	0	0

Table 7 Answer Distribution in Interventional Group

Items	Correct in Interventional P: Partially Correct, A: Completely Correct)			Wrong in Interventional			Not Answered in Interventional		
	0M	3M	6M	0M	3M	6M	0M	3M	6M
1.Which of the following are risk factors for COPD?	P 9(21.9%) C6(14.6%)	P 22(53.7%)C 17(41.5%)	P13(31.7%) C27(65.9%)	26(63.5%)	2(4.8%)	1(2.4%)	0	0	0
2.In which season is COPD most commonly diagnosed?	24(58.5%)	37(90.2%)	40(97.6%)	17(41.5%)	4(9.8%)	1(2.4%)	0	0	0
3.What are the main symptoms of COPD?	P 12(29.3%)C 6(14.6%)	P 13(31.7%)C 27(65.9%)	P 9(21.9%) C32(78.1%)	23(56.1%)	1(2.4%)	0	0	0	0
4.What are the main clinical symptoms during a COPD exacerbation?	P 9(21.9%) C 4(9.8%)	P 18(43.9%)C 21(51.2%)	P 14(34.1%)C 25(61%)	28(68.3%)	2(4.9%)	2(4.9%)	0	0	0
5.Which of the following tests is used to diagnose COPD?	15(36.6%)	29(70.7%)	37(90.2%)	26(63.4%)	12(29.3%)	4(9.8%)	0	0	0
6.Is long-term medication therapy necessary for COPD?	16(39%)	34(82.9%)	38(85.4%)	25(61%)	7(17.1%)	3(14.6%)	0	0	0
7.What is the primary medication for treating COPD?	11(26.8%)	28(68.3%)	36(87.8%)	30(73.2%)	13(31.7%)	5(12.2%)	0	0	0
8.What is the main approach to medication during the stable phase of COPD?	12(29.3%)	21(51.2%)	33(80.5%)	29(70.7%)	20(48.8%)	8(19.5%)	0	0	0
9.Does quitting smoking help improve symptoms associated with COPD?	34(82.9%)	41(100%)	41(100%)	7(17.1%)	0	0	0	0	0
10.Is annual pneumonia vaccination recommended for COPD patients?	2(4.9%)	5(12.2%)	28(68.3%)	39(95.1%)	36(87.8%)	13(31.7%)	0	0	0

correlations, which is expected given the concise nature of the questionnaire, covering various aspects such as disease etiology, symptoms, diagnosis, treatment, and prevention with fewer items.

Additionally, the COPD-ES questionnaire utilizes various formats, including open-ended and yes/no questions. Open-ended questions offer flexibility for deeper patient reflection, potentially enhancing response authenticity by avoiding superficial answers. Yes/no questions are more easily accepted and facilitate simpler scoring. The inclusion of an "I don't know" option in response choices aims to address issues observed in prior research and clinical practice, where some patients may randomly select answers to avoid thoughtful consideration. This option helps filter out such responses, contributing to more meaningful data and potentially guiding personalized disease education efforts. Overall, the COPD-ES questionnaire developed in this study is scientifically robust, effective, and reliable.

Patient-centered disease education interventions have been proven beneficial for patients with non-communicable diseases such as COPD, evident in improvements in symptoms and significant reductions in emergency visits. The study by Bourbeau et al demonstrated that COPD patients participating in a comprehensive patient education program lasting 2 months with monthly telephone follow-ups had lower referral rates than the control group over a 12-month period.[6] In the present study, compared to the control group, the COPD-ES-questionnaire-based intervention method notably improved smoking cessation, medication adherence, and disease group reclassification of stable phrase COPD patients. This study indicated that the disease education model implemented in this study also significantly improves patients' understanding of disease-related knowledge, as well as their symptoms and quality of life. In Ching-Hsiung Lin et al's study on the impact of comprehensive disease management program duration on COPD outcomes, CAT scores were the primary focus. They observed significant improvements in COPD-specific health status and notable reductions in CAT scores following intervention, particularly in patients with baseline CAT scores ≥10.[16] Similarly, in our study, the control and intervention group exhibited no differences at the baseline in CAT score. After 6 months COPD-ES questionnaire-based intervention, the intervention group exhibited notable decreased CAT scores. However, no significant differences could be observed during the follow-up at the 3rd and 6th months. This indicated this intervention can produce significant effects in less than 6 months. van Boven JF studied pharmacological interventions in COPD patients, finding minimal change in mMRC scores post-intervention.[17] In contrast, our 6-month disease education intervention significantly reduced mMRC scores compared to baseline in the intervention group. Differences in intervention methods, content, and duration likely account for these discrepancies. However, our study faced challenges when comparing mMRC score changes between control and intervention groups. Despite similar baseline lung function (p=0.442), significant differences were observed in self-reported mMRC scores at baseline (p<0.001). Therefore, we cannot definitively conclude that mMRC scores decreased more in the intervention group compared to the control group after 6 months of intervention. Further statistical analysis revealed significant improvements not only in smoking cessation rates, medication adherence, CAT scores, and mMRC grades but also in the frequency of acute exacerbations during follow-up and the final reclassification outcomes.

Another notable and crucial finding is the number of smoking cessation people which was up to 21/29 (88%) in the interventional group, while the number is 0 in control group. Smoking cessation could be one of the most important self-management measures. Aldo Pezzuto and et al reported even a short-term smoking cessation could improve symptoms, respiratory function and metabolic parameters.[18] Additionally, a retrospective study found that, for COPD patients requiring single inhaler triple therapy, smoking cessation for over six months can enhance medication efficacy and improve both clinical and functional outcomes.[19] We believe, in the present study, that regularly completing the questionnaire can remind patients of the importance of smoking cessation and other adverse health consequences associated with the disease, thereby reinforcing the concept that quitting smoking is beneficial for their condition.

This study innovatively involves monthly scheduled contacts via telephone or other online communication tools initiated by researchers rather than prompted by patient complaints or symptoms. These regular interactions may subtly encourage patients to focus on improving daily self-management behaviors like avoiding cold exposure, harmful smoke, adhering to medications, and increasing exercise. Patients are also motivated to actively seek COPD-related knowledge to prevent symptom worsening during these monthly contacts, setting this study apart from previous research.

There are also limitations merit consideration. Firstly, this is a single-center study with all the participants come from a large-scale general hospital in a big city. The applicability of this conclusion to patients in other remote regions or those

with markedly different cultural backgrounds remains uncertain. Further, the majority of the participants are male, we were unable to assess whether gender influenced the final intervention outcomes in this study. Moreover, this study had a short 6-month follow-up period, which makes it uncertain if the effects observed can be maintained long-term or if longer follow-up is needed to reduce future acute exacerbation risks. Additionally, cost-effectiveness was not evaluated in this study.

The present study designed and validated a COPD-ES questionnaire with only 10 items, demonstrating good reliability and validity. Application of this custom questionnaire in educational interventions for stable COPD patients confirmed that this patient-centered approach significantly enhanced disease knowledge, increased smoking cessation rates and medication adherence, and improved symptom control and quality of life. And this could give rise to the construction of a more time-and-labor-saving self-management strategy for stable COPD patients.

Data Sharing Statement

All methodologies and raw data can be made available upon request from the corresponding author.

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Disclosure

The authors report no conflicts of interest in this work.

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