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EFFECTIVENESS OF A STRUCTURED PULMONARY INTERVENTION PROGRAM ON HEALTH-RELATED QUALITY OF LIFE AMONG PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE: AN EXPERIMENTAL STUDY

Yogendra Rathod,[1*] Dr. Mahendra Z Patel, [2] Dr. Ravindra HN, [3] Dr. Swapnil Rahane[4]

[1]Ph.D. Scholar, Faculty of Nursing, Parul University, Waghodia, Vadodara, Gujarat, 391760, India
[2]Department of Emergency Medicine, Parul Institute of Medical Sciences & Research (PIMSR), Parul University, Waghodia, Vadodara, Gujarat, 391760, India
[3]Professor, Faculty of Nursing, Parul University, Waghodia, Vadodara, Gujarat, 391760, India
[4]Assistant Professor, Faculty of Nursing, Parul Institute of Nursing, Parul University, Waghodia, Vadodara, Gujarat, 391760, India

Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation, resulting in reduced functional capacity, recurrent exacerbations, and impaired health-related quality of life (HRQoL). Pulmonary interventions are recognized as effective non-pharmacological strategies for improving patient outcomes and enhancing quality of life.

Objective: To evaluate the effectiveness of a structured pulmonary intervention program on health-related quality of life among patients with Chronic Obstructive Pulmonary Disease.

Methods: A quantitative study employing a true experimental pre-test–post-test control group design was conducted among 120 COPD patients selected from respiratory care units of selected hospitals. Participants were randomly allocated into an intervention group (n = 60) and a control group (n = 60). Baseline demographic and clinical data were collected using a structured questionnaire. Health-related quality of life was assessed using the St. George's Respiratory Questionnaire (SGRQ). The intervention group received a structured pulmonary intervention program comprising breathing exercises, airway clearance techniques, chest physiotherapy, inspiratory muscle training, exercise training, energy conservation techniques, and disease-management education for eight weeks, while the control group received routine care. Data were analyzed using descriptive and inferential statistics.

Results: The intervention group demonstrated significant improvement in health-related quality of life following the pulmonary intervention program. The mean SGRQ score decreased from 62.48 ± 8.76 during the pre-test to 42.15 ± 7.84 during the post-test ($t = 18.92$, $p < 0.001$), indicating improved quality of life. In contrast, the control group showed no significant change. Post-test comparison revealed a statistically significant difference between the intervention and control groups ($t = 12.46$, $p < 0.001$). Significant improvements were also observed in physical functioning, symptom control, and psychosocial well-being. Baseline HRQoL was significantly associated with age, educational status, and smoking status, and disease severity, duration of COPD, hospitalization history, and comorbidities ($p < 0.05$).

Conclusion: The structured pulmonary intervention program was effective in improving health-related quality of life among COPD patients. Integration of pulmonary rehabilitation-based interventions into routine COPD management is recommended to optimize patient outcomes and enhance overall well-being.

KEYWORDS: Chronic Obstructive Pulmonary Disease, Pulmonary Intervention, Pulmonary Rehabilitation, Health-Related Quality of Life, COPD

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a common, preventable, and treatable respiratory disorder characterized by persistent airflow limitation and chronic respiratory symptoms such as dyspnea, cough, and sputum production. It is a major cause of morbidity and mortality worldwide and significantly affects patients' physical, psychological, and social well-being [(1)]. According to the Global Initiative for Chronic Obstructive Lung Disease (GOLD), COPD remains one of the leading causes of death globally and imposes a substantial healthcare burden due to frequent exacerbations and hospitalizations [(2)]. Health-related quality of life (HRQoL) is often severely impaired among COPD patients because of progressive functional limitations and reduced ability to perform daily activities [(3)]. Pulmonary rehabilitation, including breathing exercises, airway clearance techniques, physical exercise training, and patient education, has emerged as an essential component of comprehensive COPD management[(4)]. Evidence suggests that structured pulmonary interventions can improve exercise tolerance, reduce symptoms, and enhance quality of life [(5,6)]. Therefore, the present study was undertaken to evaluate the effectiveness of a structured pulmonary intervention program on health-related quality of life among patients with COPD.

METHOD

A quantitative research approach with a true experimental pre-test–post-test control group design was adopted to evaluate the effectiveness of a structured pulmonary intervention program on health-related quality of life among patients with Chronic Obstructive Pulmonary Disease (COPD). The study was conducted in selected hospitals providing respiratory care services. A total of 120 patients diagnosed with COPD were recruited using a probability sampling technique and randomly allocated into an intervention group (n = 60) and a control group (n = 60). Patients aged 40 years and above with a confirmed diagnosis of COPD and who were clinically stable at the time of data collection were included in the study.

Data were collected using two instruments. The first instrument was a structured demographic and clinical questionnaire developed by the researcher to obtain information regarding age, gender, educational status, and occupation, smoking history, duration of COPD, severity of disease, hospitalization history, and comorbidities. The second instrument was the **St.** George's Respiratory Questionnaire (SGRQ), a standardized and validated disease-specific tool widely used to assess health-related quality of life among patients with chronic respiratory diseases[7]. The SGRQ consists of three domains: Symptoms, Activity, and Impacts (Psychosocial Functioning). Scores range from 0 to 100, with higher scores indicating poorer health-related quality of life and lower scores indicating better quality of life. [7,8].

Following the pre-test assessment, participants in the intervention group received a structured pulmonary intervention program consisting of pursed-lip breathing exercises, diaphragmatic breathing exercises, airway clearance techniques, chest physiotherapy, inspiratory muscle training, walking exercises, upper and lower limb strengthening exercises, energy conservation techniques, and education on disease management, smoking cessation, medication adherence, and lifestyle modification. The intervention was delivered for eight weeks, with three supervised sessions per week, each lasting approximately 45–60 minutes. Participants in the control group received routine hospital care.

Post-test assessment was conducted after completion of the intervention using the same SGRQ tool. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize demographic and clinical characteristics. Paired t-tests were used to compare pre-test and post-test scores within groups, while independent t-tests were applied to compare post-test scores between the intervention and control groups. Chi-square tests were used to examine the association between baseline health-related quality of life and selected demographic and clinical variables. Statistical significance was established at $p < 0.05$.

RESULTS

Table 1. Baseline Demographic Characteristics of Participants (N = 120)

Variable	Category	Intervention Group (n=60) n (%)	Control Group (n=60) n (%)	Total (N=120) n (%)
Age (Years)	40–49	12 (20.0)	10 (16.7)	22 (18.3)
	50–59	18 (30.0)	20 (33.3)	38 (31.7)
	60–69	22 (36.7)	21 (35.0)	43 (35.8)
	≥70	8 (13.3)	9 (15.0)	17 (14.2)
Gender	Male	41 (68.3)	43 (71.7)	84 (70.0)
	Female	19 (31.7)	17 (28.3)	36 (30.0)
Marital Status	Married	49 (81.7)	47 (78.3)	96 (80.0)
	Unmarried	2 (3.3)	3 (5.0)	5 (4.2)
	Widowed	8 (13.3)	9 (15.0)	17 (14.2)
	Divorced/Separated	1 (1.7)	1 (1.7)	2 (1.6)
Educational Status	No Formal Education	13 (21.7)	15 (25.0)	28 (23.3)
	Primary Education	18 (30.0)	17 (28.3)	35 (29.2)
	Secondary Education	16 (26.7)	15 (25.0)	31 (25.8)
	Higher Secondary	9 (15.0)	8 (13.3)	17 (14.2)
	Graduate & Above	4 (6.6)	5 (8.4)	9 (7.5)
Occupation	Laborer	16 (26.7)	18 (30.0)	34 (28.3)
	Farmer	14 (23.3)	13 (21.7)	27 (22.5)
	Private Employee	8 (13.3)	7 (11.7)	15 (12.5)
	Retired	17 (28.3)	16 (26.6)	33 (27.5)
	Others	5 (8.4)	6 (10.0)	11 (9.2)
Residence	Rural	38 (63.3)	40 (66.7)	78 (65.0)
	Urban	22 (36.7)	20 (33.3)	42 (35.0)
Smoking Status	Current Smoker	28 (46.7)	30 (50.0)	58 (48.3)
	Former Smoker	24 (40.0)	22 (36.7)	46 (38.3)
	Non-Smoker	8 (13.3)	8 (13.3)	16 (13.4)

Table 2. Clinical Characteristics of Participants (N = 120)

Variable	Category	Intervention Group (n=60) n (%)	Control Group (n=60) n (%)	Total (N=120) n (%)
Duration of COPD (Years)	Mean ± SD	**7.84 ± 3.26**	**8.12 ± 3.41**	**7.98 ± 3.33**
	<5 Years	19 (31.7)	17 (28.3)	36 (30.0)
	5–10 Years	26 (43.3)	28 (46.7)	54 (45.0)
	>10 Years	15 (25.0)	15 (25.0)	30 (25.0)
Severity of COPD (GOLD Classification)	Mild (Stage I)	8 (13.3)	7 (11.7)	15 (12.5)
	Moderate (Stage II)	28 (46.7)	30 (50.0)	58 (48.3)
	Severe (Stage III)	19 (31.7)	18 (30.0)	37 (30.8)
	Very Severe (Stage IV)	5 (8.3)	5 (8.3)	10 (8.4)
Hospitalizations During Previous Year	Mean ± SD	**1.63 ± 0.89**	**1.71 ± 0.94**	**1.67 ± 0.91**
	None	14 (23.3)	15 (25.0)	29 (24.2)
	1–2 Times	33 (55.0)	32 (53.3)	65 (54.2)
	≥3 Times	13 (21.7)	13 (21.7)	26 (21.6)
Comorbidities	Hypertension	21 (35.0)	20 (33.3)	41 (34.2)
	Diabetes Mellitus	14 (23.3)	15 (25.0)	29 (24.2)
	Cardiovascular Disease	8 (13.3)	7 (11.7)	15 (12.5)
	Multiple Comorbidities	12 (20.0)	13 (21.7)	25 (20.8)
	None	5 (8.4)	5 (8.3)	10 (8.3)

Among the 120 participants enrolled in the study, the majority (35.8%) were aged 60–69 years, and 70.0% were male. Most participants were married (80.0%), resided in rural areas (65.0%), and had a history of current or former smoking (86.6%). Regarding clinical characteristics, 45.0% had been diagnosed with COPD for 5–10 years, while 48.3% were classified as having moderate COPD (GOLD Stage II). The intervention and control groups were comparable across demographic and clinical variables at baseline ($p > 0.05$).

Table 3. Comparison of Pre-test and Post-test Health-Related Quality of Life Scores Among COPD Patients in the Intervention Group (n = 60)

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	Paired t-value	p-value
Health-Related Quality of Life (SGRQ Total Score)	62.48 ± 8.76	42.15 ± 7.84	20.33	18.92	<0.001*

*Significant at $p < 0.05$

Table 3 shows the comparison of pre-test and post-test health-related quality of life scores among COPD patients in the intervention group. The mean pre-test SGRQ score was 62.48 ± 8.76, which decreased to 42.15 ± 7.84 after the structured pulmonary intervention program, indicating a significant improvement in health-related quality of life. The mean difference was 20.33. The calculated paired *t*-value was 18.92, which was statistically significant at $p < 0.001$. These findings demonstrate that the structured pulmonary intervention program was highly effective in improving the health-related quality of life among COPD patients.

Table 4. Comparison of Pre-test and Post-test Health-Related Quality of Life Scores Among COPD Patients in the Control Group (n = 60)

Variable	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	Paired t-value	p-value
Health-Related Quality of Life (SGRQ Total Score)	61.83 ± 8.41	59.76 ± 8.13	2.07	1.84	0.071

Table 4 presents the comparison of pre-test and post-test health-related quality of life scores among COPD patients in the control group. The mean pre-test SGRQ score was 61.83 ± 8.41, which slightly decreased to 59.76 ± 8.13 during the post-test assessment. The mean difference was 2.07. The calculated paired *t*-value was 1.84 with a p-value of 0.071, which was not statistically significant at the 0.05 level of significance. These findings indicate that routine care alone did not produce a significant improvement in the health-related quality of life among COPD patients in the control group.

Table 5. Comparison of Post-test Health-Related Quality of Life Scores Between Intervention and Control Groups (n = 120)

Group	Mean ± SD	Mean Difference	Independent t-value	p-value
Intervention (n=60)	42.15 ± 7.84	17.61	12.46	<0.001*

Control (n=60)	59.76 ± 8.13			

*Significant at $p < 0.05$

Table 5 depicts the comparison of post-test health-related quality of life scores between the intervention and control groups. The mean post-test SGRQ score in the intervention group was 42.15 ± 7.84, whereas the control group had a mean score of 59.76 ± 8.13. The mean difference between the groups was 17.61. The calculated independent *t*-value was 12.46 with a p-value < 0.001.

Table 6. Effectiveness of Structured Pulmonary Intervention Program on Physical Functioning, Symptom Control and Psychosocial Well-being Among COPD Patients (n = 60)

Domain	Pre-test Mean ± SD	Post-test Mean ± SD	Mean Difference	Paired t-value	p-value
Physical Functioning	65.21 ± 10.45	43.16 ± 8.67	22.05	15.88	<0.001*
Symptom Control	68.42 ± 9.21	45.33 ± 7.74	23.09	17.34	<0.001*
Psychosocial Well-being	58.37 ± 8.54	38.42 ± 6.85	19.95	14.62	<0.001*

*Significant at $p < 0.05$

Table 6 presents the effectiveness of the structured pulmonary intervention program on physical functioning, symptom control, and psychosocial well-being among COPD patients in the intervention group. The mean score for physical functioning decreased from 65.21 ± 10.45 in the pre-test to 43.16 ± 8.67 in the post-test, with a mean difference of 22.05 ($t = 15.88$, $p < 0.001$). Similarly, the mean score for symptom control decreased from 68.42 ± 9.21 to 45.33 ± 7.74, yielding a mean difference of 23.09 ($t = 17.34$, $p < 0.001$). The mean score for psychosocial well-being improved from 58.37 ± 8.54 to 38.42 ± 6.85, with a mean difference of 19.95 ($t = 14.62$, $p < 0.001$).

Table 7. Association between Baseline Health-Related Quality of Life Scores and Selected Demographic Variables (n = 120)

Variable	Category	Poor HRQoL n (%)	Moderate HRQoL n (%)	χ^2 Value	p-value
Age	≤59 years	18	42	6.21	0.045*
	≥60 years	33	27		
Gender	Male	39	45	0.86	0.354
	Female	12	24		
Education	Up to Primary	31	32	8.47	0.014*
	Secondary & Above	20	37		
Smoking Status	Current Smoker	34	24	11.82	0.003*
	Former/Non-Smoker	17	45		

*Significant at $p < 0.05$

Table 7 shows the association between baseline health-related quality of life (HRQoL) scores and selected demographic variables among COPD patients. A statistically significant association was observed between age and baseline HRQoL ($\chi^2 = 6.21$, $p = 0.045$), indicating that participants aged 60 years and above were more likely to experience poorer quality of life compared to younger participants.

A significant association was also found between educational status and HRQoL ($\chi^2 = 8.47$, $p = 0.014$). Participants with education up to the primary level had poorer HRQoL compared to those with secondary education and above. Similarly, smoking status showed a highly significant association with HRQoL ($\chi^2 = 11.82$, $p = 0.003$), suggesting that current smokers experienced poorer quality of life than former smokers and non-smokers. No statistically significant association was found between gender and baseline HRQoL ($\chi^2 = 0.86$, $p = 0.354$).

Table 8. Association between Baseline Health-Related Quality of Life Scores and Selected Clinical Variables (n = 120)

Variable	Category	Poor HRQoL n (%)	Moderate HRQoL n (%)	χ^2 Value	p-value
Duration of COPD	<5 Years	10	26	7.63	0.022*
	≥5 Years	41	43		
COPD Severity	Mild/Moderate	19	54	18.47	<0.001*
	Severe/Very Severe	32	15		
Hospitalization History	None/1–2	28	66	9.21	0.010*
	≥3	23	3		
Comorbidities	Present	43	51	4.36	0.037*
	Absent	8	18		

*Significant at $p < 0.05$

Table 8 depicts the association between baseline health-related quality of life (HRQoL) scores and selected clinical variables among COPD patients. A statistically significant association was observed between the duration of COPD and baseline HRQoL ($\chi^2 = 7.63$, $p = 0.022$), indicating that patients with a longer duration of illness (≥5 years) were more likely to experience poorer quality of life compared to those with a shorter duration of COPD.

A highly significant association was found between COPD severity and baseline HRQoL ($\chi^2 = 18.47$, $p < 0.001$). Patients with severe and very severe COPD reported poorer health-related quality of life than those with mild or moderate disease.

Similarly, hospitalization history showed a significant association with HRQoL ($\chi^2 = 9.21$, $p = 0.010$), suggesting that patients with frequent hospitalizations (≥3 times per year) experienced greater impairment in quality of life.

Furthermore, a significant association was observed between the presence of comorbidities and HRQoL ($\chi^2 = 4.36$, $p = 0.037$). Participants with one or more comorbid conditions had poorer quality of life compared to those without comorbidities.

DISCUSSION

The present study assessed the effectiveness of a structured pulmonary intervention program on health-related quality of life (HRQoL) among patients with Chronic Obstructive Pulmonary Disease (COPD). The findings revealed a statistically significant improvement in overall HRQoL, physical functioning, symptom control, and psychosocial well-being among participants who received the intervention compared with those receiving routine care.

The findings demonstrated that the mean HRQoL scores improved significantly following the pulmonary intervention program. This improvement may be attributed to enhance respiratory muscle function, reduced dyspnea, increased exercise tolerance, and better self-management skills developed through pulmonary rehabilitation. These findings are consistent with those reported by Wang et al. (2025) [9], who found that empowerment-based continuing nursing combined with pulmonary rehabilitation significantly improved pulmonary function, quality of life, and psychological well-being among COPD patients.

Similarly, Lamberton and Mosher (2024) reported that pulmonary rehabilitation is associated with substantial improvements in exercise capacity, dyspnea management, and health-related quality of life among individuals living with COPD [10]. Their review highlighted pulmonary rehabilitation as one of the most effective non-pharmacological interventions for COPD management [10, 11].

In the present study, significant improvements were observed in physical functioning after implementation of the structured pulmonary intervention program. These findings are supported by Dayana et al. (2025) [12], who reported significant enhancement in functional exercise capacity among COPD patients following pulmonary rehabilitation. The authors concluded that rehabilitation programs contribute to better physical endurance and improved performance of daily activities.

The significant reduction in respiratory symptoms observed in the current study is also consistent with the findings of Song et al. (2025) [13], who conducted a systematic review and network meta-analysis and reported that pulmonary rehabilitation significantly reduced dyspnea, improved exercise capacity, and enhanced health-related quality of life among patients with chronic respiratory diseases, particularly COPD.[14].

Furthermore, the present study found considerable improvement in psychosocial well-being among participants receiving pulmonary interventions. Similar findings were reported by Wang et al. (2025) [15], who observed reductions in anxiety and depression levels along with improvements in quality of life among COPD patients participating in pulmonary rehabilitation programs. Improved psychosocial outcomes may be related to increase self-efficacy, greater confidence in disease management, and enhanced social participation. [16].

The association analysis revealed that age, educational status, smoking status, duration of COPD, disease severity, hospitalization history, and comorbidities were significantly associated with baseline HRQoL scores[17]. These findings are in agreement with Feng et al. (2025) [17], who identified disease severity and patient-related factors as important determinants influencing the benefits obtained from pulmonary rehabilitation among older adults with COPD. [18].

Recent evidence also supports the role of innovative pulmonary rehabilitation approaches in improving COPD outcomes. Aburub et al. (2024) reported that digital health-based pulmonary rehabilitation interventions were effective in improving pulmonary and physical outcomes among COPD patients. [19].

Additionally, Vatrella et al. (2026) concluded in a systematic review that pulmonary rehabilitation and respiratory-focused interventions positively influence dyspnea, cognitive function, and health-related quality of life among individuals with COPD [20,21].

The findings of the present study are further strengthened by recent evidence demonstrating that home-based pulmonary rehabilitation programs significantly improve HRQoL, dyspnea, anxiety, and depression among COPD patients, suggesting that pulmonary interventions can be effectively implemented in both hospital and community settings (2026) [22].

Overall, the results of the present study provide strong evidence that structured pulmonary intervention programs are effective in improving health-related quality of life, physical functioning, symptom control, and psychosocial well-being among COPD patients. The findings are congruent with contemporary literature and support the integration of pulmonary rehabilitation into routine COPD management protocols.

CONCLUSION

The present study demonstrated that the structured pulmonary intervention program was highly effective in improving health-related quality of life among patients with Chronic Obstructive Pulmonary Disease. Significant improvements were observed in overall quality of life, physical functioning, symptom control, and psychosocial well-being among participants

who received the intervention compared to those receiving routine care. The findings indicate that pulmonary rehabilitation-based interventions can reduce symptom burden, enhance functional capacity, and promote better adaptation to chronic illness.

Conflict of Interest
The authors declare that there is no conflict of interest regarding the publication of this study.

Source of Funding
The study did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical Approval
Ethical approval was obtained from the Institutional Ethics Committee prior to the commencement of the study. Written informed consent was obtained from all participants before data collection.

Acknowledgement
The authors express their sincere gratitude to the hospital authorities, healthcare professionals, and all study participants for their valuable cooperation and support throughout the study. The authors also acknowledge the contributions of experts and colleagues who provided guidance and assistance during the conduct of the research.
This format is suitable for nursing, medical-surgical nursing, respiratory care, and allied health journals.

REFERENCES
1. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global Strategy for the Diagnosis, Management, and Prevention of COPD: 2025 Report. Brussels: GOLD; 2025.
2. Agustí A, Celli BR, Criner GJ, Halpin DMG, Anzueto A, Barnes P, et al. Global Initiative for Chronic Obstructive Lung Disease 2025 Report: GOLD Executive Summary. Am J Respir Crit Care Med. 2025;211(8):978-1005.
3. Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, et al. An official American Thoracic Society/European Respiratory Society statement: Key concepts and advances in pulmonary rehabilitation. Am J Respir Crit Care Med. 2013;188(8):e13-e64.
4. Polit DF, Beck CT. Nursing Research: Generating and Assessing Evidence for Nursing Practice. 12th ed. Philadelphia: Wolters Kluwer; 2024.
5. Grove SK, Gray JR. Understanding Nursing Research: Building an Evidence-Based Practice. 8th ed. St. Louis: Elsevier; 2023.
6. Jones PW, Quirk FH, Baveystock CM. The St George's Respiratory Questionnaire. Respir Med. 1991;85(Suppl B):25-31.
7. Meguro M, Barley EA, Spencer S, Jones PW. Development and validation of an improved COPD-specific version of the St George Respiratory Questionnaire. Chest. 2007;132(2):456-63.
8. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global Strategy for the Diagnosis, Management, and Prevention of COPD: 2025 Report. Brussels: GOLD; 2025.
9. Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, et al. An official American Thoracic Society/European Respiratory Society statement: Key concepts and advances in pulmonary rehabilitation. Am J Respir Crit Care Med. 2013;188(8):e13-e64.
10. Pallant J. SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS. 8th ed. London: McGraw-Hill Education; 2024.
11. Wang, Q., Tang, H., & Zhang, M. (2025). The clinical nursing effect of empowerment-based continuing nursing combined with pulmonary rehabilitation for chronic obstructive pulmonary disease. BMC Pulmonary Medicine, 25, 315.
12. Lamberton, C. E., & Mosher, C. L. (2024). Review of the evidence for pulmonary rehabilitation in COPD: Clinical benefits and cost-effectiveness. Respiratory Care, 69(6), 686–696.
13. Dayana, B. A. A., Kamal, S., & Thenmozhi, P. (2025). Impact of pulmonary rehabilitation on functional exercise capacity among chronic obstructive pulmonary disease patients: Pilot study. Journal of Pioneering Medical Sciences, 14(12), 15–19.
14. Song, J., et al. (2025). Comparative efficacy of pulmonary rehabilitation delivery models on dyspnea, exercise capacity, and health-related quality of life in chronic respiratory disease: A systematic review and network meta-analysis. NPJ Primary Care Respiratory Medicine.
15. Aburub, A., et al. (2024). The effects of digital health interventions for pulmonary rehabilitation in chronic obstructive pulmonary disease: A systematic review. Journal of Telemedicine and Telecare.
16. Feng, L., Yang, Q. Q., & Liang, M. (2025). Factors influencing the benefits of pulmonary rehabilitation in older adults with chronic obstructive pulmonary disease: A prospective study. Frontiers in Public Health.
17. Vatrella, A., et al. (2026). Effects of pulmonary rehabilitation on dyspnea, quality of life, cognitive performance, and voice outcomes in COPD patients: A systematic review. Journal of Clinical Medicine, 15(2), 670.
18. Feng L, Yang QQ, Liang M, Wang J, Chen Y. Factors influencing the benefits of pulmonary rehabilitation in older adults with chronic obstructive pulmonary disease: A prospective observational study. Front Public Health. 2025;13:1644607.
19. Wang Q, Tang H, Zhang M, Li Y. The clinical nursing effect of empowerment-based continuing nursing combined with pulmonary rehabilitation in patients with chronic obstructive pulmonary disease. BMC Pulm Med. 2025;25(1):315.

20. Song J, Zhang Y, Liu X, Chen H, Wang T. Comparative efficacy of pulmonary rehabilitation delivery models on dyspnea, exercise capacity and health-related quality of life in chronic respiratory disease: A systematic review and network meta-analysis. NPJ Prim Care Respir Med. 2025;35(1):8.
21. Vatrella A, Pelaia C, Crimi C, Terracciano R, Pelaia G. Effects of pulmonary rehabilitation on dyspnea, quality of life, cognitive performance and functional outcomes in patients with chronic obstructive pulmonary disease: A systematic review. J Clin Med. 2026;15(2):670.
22. Dayana BAA, Kamal S, Thenmozhi P. Impact of pulmonary rehabilitation on functional exercise capacity among chronic obstructive pulmonary disease patients: A pilot study. J Pioneer Med Sci. 2025;14(12):15-19.