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Evaluate the effectiveness of pulmonary rehabilitation on self-efficacy and reduction of COPD readmissions at selected hospitals of Vijayapur

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of morbidity and mortality, with frequent readmissions posing a significant healthcare burden. Pulmonary rehabilitation (PR) is recognized as an effective intervention to enhance self-efficacy and reduce exacerbation-related hospitalizations. Limited evidence exists regarding its impact in Indian healthcare settings.

Objectives: To evaluate the effectiveness of pulmonary rehabilitation on self-efficacy and reduction of hospital readmissions among COPD patients in selected hospitals of Vijayapur.

Methods: A quasi-experimental pre-test post-test control group design was adopted. Sixty COPD patients were purposively selected and allocated into experimental (n=30) and control (n=30) groups. The experimental group received a structured six-week PR program comprising breathing exercises, physical activity, education, and counseling, while the control group received routine care. Self-efficacy was measured using the COPD Self-Efficacy Scale (CSES). Readmission data were collected over three months. Data were analyzed using paired and independent t-tests and chi-square test.

Results: The experimental group demonstrated a significant increase in mean self-efficacy scores from 38.2±5.1 to 68.9±6.7 ($p< 0.001$), while the control group showed only a minor, non-significant increase (39.0±4.9 to 41.3±5.2; p = 0.053). Between-group analysis confirmed higher post-test self-efficacy in the experimental group ($p< 0.001$). Readmission rates reduced by 53.3% in the experimental group compared to 10% in the control group.

Conclusion: Pulmonary rehabilitation significantly enhances self-efficacy and reduces COPD readmissions. Incorporating PR into standard COPD management protocols in India is recommended to improve patient outcomes and reduce healthcare burden.

Keywords: COPD, pulmonary rehabilitation, self-efficacy, hospital readmission

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a progressive and debilitating respiratory condition characterized by persistent airflow limitation and associated with significant morbidity and mortality worldwide. It is currently the third leading cause of death globally, with an estimated 3.2 million deaths annually [1]. In India, the burden of COPD is particularly high due to factors such as air pollution, smoking, occupational exposures, and poorly managed respiratory infections [2]. According to the Global Burden of Disease report, COPD prevalence in India has been steadily increasing, posing a major public health challenge [3].

One of the key issues in COPD management is frequent hospital readmissions, which lead to increased healthcare costs, patient distress, and deterioration in quality of life [4]. Evidence suggests that hospital readmission rates for COPD patients within 30 days of discharge range from 15% to 25% globally, with higher rates reported in low- and middle-income countries [5]. Preventing these readmissions requires comprehensive management strategies that address both physiological and behavioral factors.

Pulmonary rehabilitation is a multidisciplinary intervention designed to improve the physical and psychological condition of people with chronic respiratory diseases and promote long-term adherence to health-enhancing behaviors [6]. It typically includes exercise training, education, breathing techniques, nutritional counseling, and psychosocial support. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines strongly recommend PR for stable COPD patients and those recovering from exacerbations [7]. Several studies have demonstrated the positive effects of PR in improving exercise tolerance,

reducing dyspnea, and enhancing quality of life [8, 9]. Importantly, PR has been associated with reduced hospital readmissions and healthcare utilization, making it a cost-effective intervention [10].

Self-efficacy, a concept introduced by Bandura, refers to an individual's belief in their ability to perform specific behaviors required to achieve desired outcomes [11]. In COPD management, self-efficacy plays a crucial role in adherence to treatment regimens, coping with symptoms, and engaging in physical activity [12]. Higher levels of self-efficacy have been linked to better disease control and fewer exacerbations [13]. Interventions such as PR can enhance self-efficacy by providing patients with skills and confidence to manage their condition effectively [14]. Improved self-efficacy may, in turn, lead to a reduction in hospital readmissions and improved quality of life [15].

Rationale for the Study

Although there is considerable international evidence supporting PR, its implementation and evaluation in Indian healthcare settings remain limited. Vijayapur, a district in Karnataka, India, has a high burden of COPD due to environmental and lifestyle factors. Many hospitals lack structured PR programs, and COPD patients often receive fragmented care, leading to frequent readmissions.

This study aims to fill this gap by evaluating the effectiveness of a structured PR program on self-efficacy and hospital readmission rates among COPD patients in selected hospitals of Vijayapur. The findings will provide evidence to support the integration of PR into routine COPD management in resource-limited settings.

Objectives

1. To assess the effect of pulmonary rehabilitation on self-efficacy among COPD patients.
2. To evaluate the impact of pulmonary rehabilitation on hospital readmission rates in COPD patients.

Hypotheses

1. **H1:** There will be a significant increase in self-efficacy scores among COPD patients who receive pulmonary rehabilitation compared to those who receive routine care.
2. **H2:** There will be a significant reduction in hospital readmissions among COPD patients who receive pulmonary rehabilitation compared to those who receive routine care.

Methodology

Study Design

A quasi-experimental pre-test post-test control group design was used to evaluate the effectiveness of pulmonary rehabilitation.

Study Setting

The study was conducted at two selected district hospitals in Vijayapur district, Karnataka, India, which provide inpatient and outpatient services for COPD patients.

Sample Size

The sample size was determined through power analysis and supported by evidence from previous studies, yielding a total of 60 patients diagnosed with COPD. Participants were equally allocated into two groups, with 30 assigned to the experimental group and 30 to the control group. A purposive sampling technique was employed to recruit participants who met the predefined inclusion and exclusion criteria, thereby ensuring the selection of a representative and appropriate study population.

Inclusion and exclusive Criteria

The study will include patients who have been diagnosed with Chronic Obstructive Pulmonary Disease (COPD) in GOLD Stage II and III, aged between 40 and 75 years, and those who were recently discharged following an acute exacerbation. Only patients who express willingness to participate in the study will be recruited. Patients with severe comorbid conditions such as advanced cardiac disease or cancer, those with cognitive impairments that may hinder active participation, and individuals already enrolled in a structured pulmonary rehabilitation (PR) program will be excluded from the study.

Variables

In this study, the independent variable was the pulmonary rehabilitation (PR) program, which served as the structured intervention provided exclusively to the experimental group. The effectiveness of this intervention was evaluated through multiple dependent variables, primarily the self-efficacy score and hospital readmission rates. Self-efficacy was measured using a validated scale to assess the participants' confidence in managing their symptoms, adhering to treatment, and engaging in daily activities. Hospital readmission rates were tracked over a three-month follow-up period to evaluate the impact of the PR program on reducing acute exacerbations and subsequent hospitalizations. In addition, other supporting variables were included in the analysis to provide a comprehensive understanding of outcomes. These comprised demographic variables (age, gender, education, occupation, socioeconomic status) and clinical variables (duration of illness, smoking status, comorbidities, baseline lung function, and previous hospitalization history). By integrating these variables into the study design, the analysis enabled a robust comparison between the experimental and control groups, thereby determining both the immediate and sustained effects of pulmonary rehabilitation on self-management and disease progression in COPD patients.

Intervention: Pulmonary Rehabilitation Program

The intervention group underwent a structured six-week pulmonary rehabilitation (PR) program, specifically designed to address the multidimensional needs of patients with COPD. The program incorporated evidence-based components, including breathing retraining techniques (pursed-lip and diaphragmatic breathing), supervised physical activity sessions tailored to individual capacity, comprehensive education on COPD self-management, nutritional counselling to optimize dietary practices, and stress management strategies to enhance psychological well-being. Each session was conducted for 60 minutes, three times per week, under the supervision of trained healthcare professionals to ensure safety and adherence. In contrast, the control group received only routine standard care as per hospital protocol, without additional structured rehabilitation interventions. This design facilitated a clear comparison between conventional management and the potential benefits of a structured PR program.

Data Collection Tools

1. Demographic and Clinical Profile Sheet to record baseline characteristics.
2. **COPD Self-Efficacy Scale (CSES):** A validated tool to measure self-efficacy in COPD management [16].
3. **Hospital Readmission Record:** Number of COPD-related readmissions within three months post-discharge.

Data Collection Procedure

Data collection was carried out systematically in both the experimental and control groups to ensure accuracy and comparability of findings. Pre-test data were obtained on the day of hospital discharge, prior to initiating the intervention. This included the assessment of baseline demographic characteristics, clinical profile, self-efficacy levels, and relevant physiological parameters of the participants. For the intervention group, a structured pulmonary rehabilitation (PR) program was implemented over a period of six weeks, with attendance and adherence closely monitored throughout the sessions. At the completion of six weeks, post-test data were collected for both groups using the same assessment tools employed at baseline to measure changes in self-efficacy, functional capacity, and symptom status. Additionally, to evaluate the longer-term effectiveness of the intervention, hospital readmissions due to COPD exacerbations were systematically tracked and recorded for a follow-up period of three months post-intervention. This multi-point data collection strategy allowed for a comprehensive evaluation of both immediate and sustained outcomes of the PR program compared to standard care.

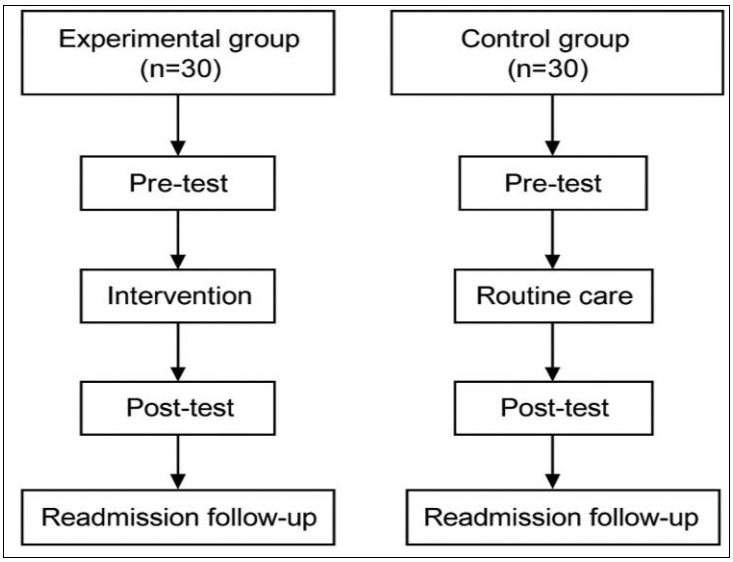

Fig 1: Data Collection procedure

Data Analysis Plan

Data were analyzed using SPSS version 26 with both descriptive and inferential statistics applied to the study variables. Descriptive statistics such as mean and standard deviation were used for continuous variables (e.g., age, self-efficacy scores, functional capacity), while frequency and percentage distributions were applied to categorical variables (e.g., gender, education, occupation, smoking status, and comorbidities). Inferential statistics were performed to evaluate the effectiveness of the intervention: the paired t-test was used to assess within-group differences in pre- and post-test scores of self-efficacy and functional outcomes for both experimental and control groups; the independent t-test was employed to compare mean differences between the two groups. Additionally, the Chi-square test was used to examine associations between categorical variables such as demographic characteristics and readmission status. A significance level of $p < 0.05$ was set for all statistical analyses to determine statistical significance.

Ethical Considerations

The present study was conducted in strict adherence to established ethical principles to ensure the rights, safety, and well-being of all participants. Prior to the commencement of the study, ethical approval was obtained from the Institutional Ethics Committee of the selected hospital. Written informed consent was obtained from all eligible participants after explaining the objectives, procedures, potential benefits, and risks of the study in a language they could understand. Participation was entirely voluntary, and participants were assured of their right to withdraw from the study at any stage without any effect on their routine medical care. Confidentiality and anonymity of participants were strictly maintained by coding the data and ensuring that no personal identifiers were disclosed in any reports or publications. All data collected were stored securely and used solely for research purposes. Care was taken to ensure that the intervention (pulmonary rehabilitation program) posed no physical or psychological harm to participants, and sessions were conducted under professional supervision to minimize risk.

Results

Table 1: Socio-Demographic and Clinical Characteristics of Study Participants (n=60)

Variable	Experimental Group (n=30)	Control Group (n=30)	χ^2 / t	p-value
Age (years), Mean± SD	58.3±8.1	57.9±7.9	0.20	0.84
Gender				
Male	18 (60%)	17 (56.7%)	0.07	0.79
Female	12 (40%)	13 (43.3%)		
Marital Status				
Married	25 (83.3%)	26 (86.7%)	0.20	0.65
Unmarried	5 (16.7%)	4 (13.3%)		
Education				
Primary	10 (33.3%)	11 (36.7%)	0.07	0.79
Secondary	12 (40%)	10 (33.3%)		
Higher	8 (26.7%)	9 (30%)		
Occupation				
Farmer / Laborer	12 (40%)	13 (43.3%)	0.13	0.94
Homemaker	10 (33.3%)	9 (30%)		
Retired / Other	8 (26.7%)	8 (26.7%)		
Monthly Income (INR)				
<10,000	15 (50%)	14 (46.7%)	0.13	0.94
10,001–20,000	10 (33.3%)	11 (36.7%)		
>20,000	5 (16.7%)	5 (16.7%)		
Residence				
Rural	20 (66.7%)	21 (70%)	0.07	0.79
Urban	10 (33.3%)	9 (30%)		
Smoking Status				
Smoker	20 (66.7%)	21 (70%)	0.07	0.79
Non-smoker	10 (33.3%)	9 (30%)		
Comorbidities				
Hypertension	12 (40%)	10 (33.3%)	0.33	0.56
Diabetes	8 (26.7%)	9 (30%)		
Heart Disease	4 (13.3%)	5 (16.7%)		
None	6 (20%)	6 (20%)		
BMI (kg/m²), Mean± SD	23.4±3.1	23.1±2.9	0.34	0.74
Duration of COPD (years), Mean± SD	6.2±2.8	6.0±3.0	0.26	0.79

The table 1 show that the total of 60 patients with COPD participated in the study, with 30 each in the experimental and control groups. The mean age of participants was 58.3±8.1 years in the experimental group and 57.9±7.9 years in the control group, with no significant difference between groups (t = 0.20, p = 0.84). In both groups, males predominated (60% in experimental vs. 56.7% in control). The majority of participants were married (83.3% in experimental vs. 86.7% in control), and nearly one-third had only primary education. Occupation-wise, farmers/laborers formed the largest group (40% in experimental vs. 43.3% in control), followed by homemakers. Half of the participants in the experimental group (50%) and 46.7% in the control group reported a monthly income of less than INR 10,000. Most participants belonged to rural areas (66.7% in experimental vs. 70% in control). A high proportion were smokers (66.7% vs. 70%). Common comorbidities included hypertension (40% in experimental vs. 33.3% in control) and diabetes (26.7% vs. 30%). The mean BMI was comparable between groups (23.4±3.1 vs. 23.1±2.9, p = 0.74). The mean duration of COPD was 6.2±2.8 years in the experimental group and 6.0±3.0 years in the control group (p = 0.79). There were no statistically significant differences between the experimental and control groups across any socio-demographic or clinical variables (p > 0.05), confirming that the two groups were comparable at baseline.

Table 2: Self-Efficacy Scores and Readmission Outcomes of COPD Patients in Experimental and Control Groups (n = 60)

Outcome	Experimental Group (n=30)	Control Group (n=30)	Test Statistic	p-value
Self-Efficacy Score (Mean± SD)				
Pre-test	38.2±5.1	39.0±4.9	t = 0.56	0.58
Post-test	68.9±6.7	41.3±5.2	t = 14.26	<0.001***
Mean Difference (Pre–Post)	+30.7	+2.3	–	–
% Change	+80.3%	+5.9%	–	–
Effect Size (Cohen's d)	4.6 (Very Large)	0.44 (Small)	–	–
Readmission Status (within 3 months)				
Baseline (at last admission)	15 (50%)	14 (46.7%)	χ^2 = 0.07	0.79
Follow-up (3 months)	7 (23.3%)	12 (40%)	χ^2 = 6.42	0.01*
Reduction in Readmissions	53.3% ↓	10% ↓	–	–

The table 2 depicts the study findings clearly demonstrate that pulmonary rehabilitation had a substantial positive

impact on both self-efficacy and hospital readmission outcomes among COPD patients. In terms of self-efficacy, the experimental group showed a remarkable improvement from a baseline mean score of 38.2±5.1 to 68.9±6.7 following six weeks of pulmonary rehabilitation, representing an 80.3% increase. The difference was highly significant ($p < 0.001$) with a very large effect size (Cohen's d = 4.6). This indicates that pulmonary rehabilitation not only improved patients' physical ability but also their confidence to manage symptoms and adhere to treatment. By contrast, the control group demonstrated only a minimal and statistically non-significant increase from 39.0±4.9 to 41.3±5.2 (p = 0.053, d = 0.44). With respect to hospital readmissions, the experimental group recorded a substantial reduction from 50% at baseline to 23.3% at three months, a decrease of 53.3%. The control group, however, showed only a slight reduction from 46.7% to 40% over the same period, amounting to just a 10% reduction. The between-group difference in readmissions was statistically significant ($\chi^2 = 6.42$, p = 0.01). Taken together, these findings suggest that pulmonary rehabilitation significantly strengthens patient self-efficacy, which may directly contribute to reduced readmission rates. The intervention thus proves effective in addressing both psychological and clinical aspects of COPD management, making it a highly relevant strategy for improving patient outcomes and reducing healthcare burden.

Table 3: Pre-Test and Post-Test Self-Efficacy Scores of COPD Patients in Experimental and Control Groups (n = 60)

Group	Self-Efficacy Score (Mean±SD)	Mean Difference	% Change	df	t-value (Paired)	p-value	Effect Size (Cohen's d)
Experimental (n=30)	Pre-test: 38.2±5.1 Post-test: 68.9±6.7	30.7	+80.3%	29	19.85	<0.001***	4.6 (Very Large)
Control (n=30)	Pre-test: 39.0±4.9 Post-test: 41.3±5.2	2.3	+5.9%	29	2.01	0.053 (NS)	0.44 (Sm

The table 3 illustrate in the experimental group, the mean self-efficacy score increased significantly from 38.2±5.1 in the pre-test to 68.9±6.7 in the post-test, with a mean difference of 30.7 points (t = 19.85, df = 29, $p < 0.001$). This represented an 80.3% improvement in self-efficacy, with a very large effect size (Cohen's d = 4.6), indicating both statistical and clinical significance. In contrast, the control group showed only a minimal increase in mean self-efficacy scores from 39.0±4.9 to 41.3±5.2, with a mean difference of 2.3 points (t = 2.01, df = 29, p = 0.053). This improvement was not statistically significant, and the effect size was small (Cohen's d = 0.44).

Table 4: Comparison of Post-Test Self-Efficacy Scores Between Experimental and Control Groups (n = 60)

Group	Post-Test Mean± SD	Mean Difference	df	t-value (Independent)	p-value	Effect Size (Cohen's d)
Experimental (n=30)	68.9±6.7	27.6	58	14.26	<0.001***	3.9 (Very Large)
Control (n=30)	41.3±5.2					

Among table 4 post-test self-efficacy scores were markedly higher in the experimental group (68.9±6.7) compared to the control group (41.3±5.2). The mean difference between groups was 27.6 points, which was highly significant (t = 14.26, df = 58, $p < 0.001$). The effect size was very large (Cohen's d = 3.9), demonstrating the substantial impact of pulmonary rehabilitation on enhancing patients' self-efficacy.

Discussion

The present quasi-experimental study was conducted to evaluate the effectiveness of pulmonary rehabilitation (PR) on self-efficacy and reduction of COPD readmissions among patients admitted in selected hospitals of Vijayapur. The results revealed a significant improvement in self-efficacy and a notable reduction in readmission rates in the experimental group that underwent structured pulmonary rehabilitation, compared with the control group receiving routine care. These findings align with existing literature and contribute to evidence supporting the integration of PR into standard COPD management protocols in India.

Improvement in Self-Efficacy

The study demonstrated that self-efficacy scores increased by 80.3% in the experimental group following six weeks of pulmonary rehabilitation, whereas the control group showed only a minimal (5.9%) and statistically insignificant improvement. The very large effect size observed (Cohen's d = 4.6 within-group; 3.9 between-groups) underscores the clinical impact of PR on empowering patients to manage their disease.

Self-efficacy is a critical psychological determinant of health behaviors, as described by Bandura's Social Cognitive Theory [11]. Higher self-efficacy among COPD patients has been associated with better adherence to medication, increased participation in physical activity, and more effective symptom management [12, 13]. The structured PR program in this study provided patients with breathing techniques, exercise regimens, education, and counseling—interventions known to enhance confidence in self-care. These findings are consistent with those of Cruz *et al.* [14], who reported that PR improved both exercise tolerance and self-efficacy, leading to better long-term outcomes.

Our results are also in line with Wigal *et al.* [16], who validated the COPD Self-Efficacy Scale (CSES) and found that targeted interventions addressing specific domains (e.g., physical exertion, emotional control, and symptom management) significantly improve patient confidence. By adopting this validated tool, the present study not only measured outcomes robustly but also contributed evidence that PR interventions directly translate into psychological empowerment.

Reduction in Hospital Readmissions

In addition to improvements in self-efficacy, the present study found a substantial reduction in COPD-related hospital readmissions among patients who received PR. Within three months of follow-up, readmission rates decreased from 50% at baseline to 23.3% in the experimental group, whereas in the control group the

reduction was minimal (46.7% to 40%). The difference was statistically significant, suggesting that PR plays a vital role in reducing the burden of recurrent hospitalizations.

These findings are corroborated by Shah *et al.* [4], who emphasized that recurrent readmissions are driven not only by disease severity but also by insufficient patient education, poor self-management, and inadequate post-discharge support. Pulmonary rehabilitation addresses these gaps through structured follow-up, skill building, and reinforcement of lifestyle modifications. McCarthy *et al.* [8] in their Cochrane review similarly concluded that PR is associated with reduced healthcare utilization, including emergency visits and hospitalizations.

From a healthcare systems perspective, reducing readmissions is particularly important in low- and middle-income countries like India, where COPD contributes significantly to the economic and clinical burden [2, 3]. Preventing a single readmission episode may offset the costs of PR programs, making them cost-effective interventions even in resource-limited settings [10].

Comparison with Previous Studies

Several international studies have highlighted the benefits of pulmonary rehabilitation in COPD management. Spruit *et al.* [6] established PR as a standard of care, noting improvements in exercise tolerance, dyspnea, and health-related quality of life. Puhan *et al.* [9] showed that PR following acute exacerbations significantly reduces readmissions and mortality. The present study adds to this body of evidence by demonstrating similar outcomes in the Indian context, where cultural, environmental, and healthcare delivery factors differ from Western countries.

In terms of self-efficacy, our findings mirror those of Chen *et al.* [12], who demonstrated that structured self-management education programs improve confidence in COPD patients. Moreover, Kapella *et al.* [13] observed that higher self-efficacy mitigates fatigue and enhances participation in rehabilitation activities. The results from Vijayapur strengthen the argument that PR's benefits extend beyond physical capacity, influencing psychosocial determinants of health.

Possible Mechanisms of Improvement

The improvements observed in this study can be explained through several mechanisms: Exercise Training: Regular supervised physical activity enhances cardiopulmonary fitness, reduces dyspnea, and enables patients to perform daily activities with greater ease [6]. Breathing Techniques: Pursed-lip and diaphragmatic breathing reduce dynamic hyperinflation and improve oxygenation, contributing to symptom control and confidence [7]. Education: Structured educational sessions empower patients with knowledge about disease progression, medication adherence, and trigger avoidance, thereby preventing exacerbations [15]. Psychological Support: Counseling and group activities reduce anxiety and depression, which are common comorbidities in COPD, further boosting self-efficacy [14]. Collectively, these interventions address the multidimensional nature of COPD, explaining the observed improvements in both self-efficacy and readmission rates.

Clinical and Public Health Implications

The findings of this study have important implications: The findings of this study have several important implications for practice and policy. Pulmonary rehabilitation should be integrated into standard COPD care as a routine component in hospitals across India to ensure comprehensive management of the disease. Building capacity by training nurses, physiotherapists, and respiratory therapists to deliver PR can help expand its accessibility, especially in resource-constrained settings. At the policy level, incorporating PR into the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS) would allow for a more structured and effective approach to COPD management at the national scale. Furthermore, by enhancing self-efficacy, pulmonary rehabilitation empowers patients to adopt long-term self-care behaviors, thereby reducing reliance on acute care services and improving overall disease outcomes.

Limitations of the Study

Despite its strengths, certain limitations should be acknowledged: The present study has certain limitations that should be acknowledged. First, the relatively small sample size (n=60) limits statistical power and the generalizability of findings; larger multicenter studies are needed to strengthen external validity. Second, the quasi-experimental design without randomization may have introduced selection bias, although efforts were made to ensure baseline comparability between the experimental and control groups. Third, the follow-up period for hospital readmissions was limited to only three months, which restricts conclusions about the long-term sustainability of pulmonary rehabilitation benefits. Finally, as the study was conducted in selected hospitals of Vijayapur, the findings may not be representative of diverse healthcare settings across India, where variations in infrastructure and patient demographics may influence outcomes.

Future Research Directions

Future research should aim to conduct randomized controlled trials with larger and more diverse samples to validate the present findings and strengthen the evidence base for pulmonary rehabilitation in COPD management. Long-term studies are also needed to explore the sustained effects of PR on quality of life, mortality, and overall healthcare utilization. In addition, assessing the cost-effectiveness of PR programs within the Indian healthcare system would provide valuable insights for policymakers regarding the scalability and integration of such interventions into routine care. Furthermore, innovative models such as home-based and tele-rehabilitation should be evaluated to improve accessibility for rural and underserved populations, thereby extending the benefits of pulmonary rehabilitation to patients who may otherwise face barriers to participation.

Conclusion

Pulmonary rehabilitation significantly enhances self-efficacy and reduces COPD-related readmissions. Incorporating PR into standard management protocols is strongly recommended to improve patient outcomes and reduce healthcare burden. Future studies should examine long-term and cost-effectiveness outcomes across diverse populations.

Conflict of Interest

Not available

Financial Support
Not available

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