

## The impacts of pulmonary rehabilitation following exacerbations of COPD on hospitalizations, significant patient outcomes, and exercise ability: Systematic review

Fatemah Mohammed Ali Alghafly <sup>1,\*</sup>, Alaa Abdulmajeed Alkhars <sup>1</sup>, Hebah Hamad Bosbait <sup>2</sup>, Reema Ali Ali Salami <sup>1</sup>, Laila Mohammed AlShaikh <sup>1</sup>, Sajidah Abdulaziz AlHashem <sup>1</sup>, Maryam Mohammed Alhajri <sup>1</sup>, Sager Almulhem <sup>3</sup>, Amal Abdullah Al Marzouq <sup>4</sup>, Adnan Khalifa Bunayan <sup>5</sup> and Nasser Mohammed Nasser Al jarah <sup>6</sup>

<sup>1</sup> Staff nurse 1 Outpatient, Nursing Department, King Abdulaziz hospital National Guard, Al-Ahsa, Saudi Arabia.

<sup>2</sup> Dermatology consultant, Internal medicine Department, Imam Abdulrahman bin Faisal Hospital, NGHHA, Dammam, Saudi Arabia.

<sup>3</sup> Assistant consultant diagnostic radiology, Radiology Department, Imam Abdulrahman bin Faisal Hospital, Dammam, Saudi Arabia.

<sup>4</sup> Staff nurse 1, Nursing Department, Imam Abdulrahman Bin Faisal Hospital, NGHHA, Dammam, Saudi Arabia.

<sup>5</sup> Physiotherapy technician, physiotherapy Department, Imam Abdulrahman Bin Faisal Hospital, NGHHA, Dammam, Saudi Arabia.

<sup>6</sup> Assistant consultant Internal Medicine, Internal Medicine, Imam Abdulrahman Bin Faisal Hospital, NGHHA, Dammam, Saudi Arabia.

World Journal of Advanced Research and Reviews, 2024, 24(01), 2717–2722

Publication history: Received on 10 September 2024; revised on 26 November 2024; accepted on 28 October 2024

Article DOI: <https://doi.org/10.30574/wjarr.2024.24.1.2943>

### Abstract

**Study aim:** This study aimed to determine how pulmonary rehabilitation following exacerbations of COPD affected hospitalizations and other significant patient outcomes.

**Method:** PRISMA criteria were followed in the conduct of this systematic review study. Randomized controlled studies that compare pulmonary rehabilitation versus conventional community care for acute exacerbations of COPD. We looked for relevant studies in the electronic databases MEDLINE, Embase, and Cochrane. We looked through databases to find studies conducted between 2004 and 2024.

**Result and conclusion:** In this systematic review analysis, four randomized controlled trials were taken into account. In one trial, participants started either inpatient or outpatient rehabilitation programs; in another, they underwent inpatient pulmonary rehabilitation starting two to eight days after being admitted to the hospital; and in a third, they underwent outpatient rehabilitation after receiving inpatient therapy for an exacerbation. Participants in two studies received very extensive pulmonary rehabilitation, while those in one study had intensive pulmonary rehabilitation. Readmissions to hospitals were reported in two studies. For these two studies, the median follow-up period was eight months. The findings of these studies showed that pulmonary rehabilitation reduced hospital readmissions.

**Keywords:** Impacts; Pulmonary Rehabilitation; Chronic Obstructive Pulmonary Disease; Patient Outcomes; Quality Of Life.

### 1. Introduction

Based on previous iterations of this systematic review and the trials it included, the American and European Respiratory Society have published clinical guidelines and documents that include positive recommendations for pulmonary rehabilitation following exacerbations of COPD (1). Recent research, however, suggests that post-exacerbation rehabilitation might not always be successful. Furthermore, there have been worries that pulmonary rehabilitation

\* Corresponding author: Fatemah Mohammed Ali Alghafly

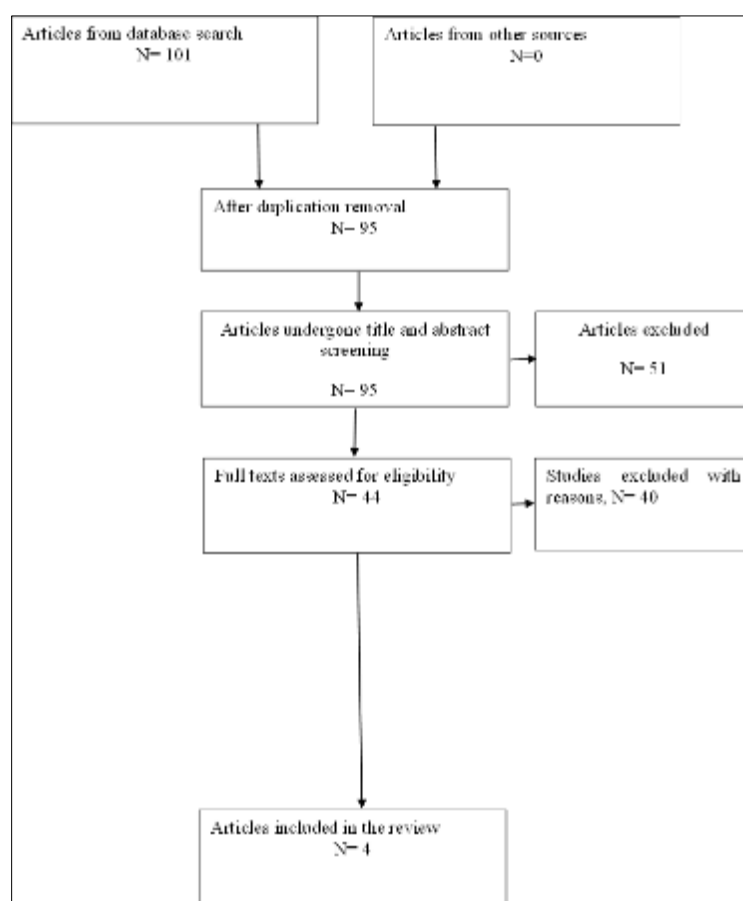
might not be safe just after COPD flare-ups. Therefore, by evaluating the efficacy and safety of pulmonary rehabilitation following COPD exacerbations, we want to update our earlier systematic review.

Both individuals and healthcare systems in developed and developing nations bear a significant health impact from COPD exacerbations and hospitalizations (2). According to Aaron et al. (3), the most frequent cause of hospitalization and mortality for people with COPD is acute exacerbations. Furthermore, compared to the healthy population, individuals with COPD have reported lower health-related quality of life, which is further hampered by acute and recurrent exacerbations (4). Patients run the risk of dying young and experiencing ongoing flare-ups that necessitate hospitalization (3). Re-hospitalization rates are approximately 60% (5), and mortality rates in the year after a hospitalization are approximately 35% (6).

Because pulmonary rehabilitation incorporates a number of interventions that are known to improve health status and prognosis, including physical exercise, quitting smoking, self-management education, medication optimization, and psychological and social support, it may be crucial to peri-exacerbation management (7).

This study sought to determine how pulmonary rehabilitation following exacerbations of COPD affected hospitalizations and other significant patient outcomes.

## 2. Method



**Figure 1** PRISMA consort chart of studies selection

This systematic review study was conducted according to PRISMA guidelines (Fig 1). Randomized controlled trials that contrast traditional community treatment with pulmonary rehabilitation during acute exacerbations of COPD. We included published data, and full-text research. Participants with COPD following inpatient or outpatient treatment for an acute exacerbation were included in the studies that our search focused on. Research participants had to have COPD in order to be eligible for this review.

Patients who have received acute care for a COPD exacerbation can participate in any inpatient or outpatient pulmonary rehabilitation program that includes physical activity, either strength or endurance, or both. Within three weeks of the start of exacerbation treatment, or soon thereafter, the rehabilitation program must become underway. Because guideline recommendations do not specify when a program qualifies as rehabilitation based on the quantity or kind of exercise sessions, we did not apply a criterion for the minimum number of exercise sessions to be included in the review. Additional elements of rehabilitation programs could include breathing exercises, food guidance, psychological assistance, and self-management education.

We searched electronic databases (MEDLINE, Embase and Cochrane) for eligible studies. Databases were searched for studies in the period from 2004 to 2024. In addition to reviewing the reference lists of the primary studies and review articles that were included, we also contacted subject-matter experts to inquire about further published and unpublished research.

The titles and abstracts of every citation that was found were evaluated independently by two review authors. After recording their decisions, review authors compared them to decide whether to reject or order the full-text paper. With careful consideration of the inclusion/exclusion criteria, we reached a compromise to settle disputes. After reviewing the whole texts of all possibly eligible publications, three authors decided whether or not to include each study based on the previously mentioned inclusion and exclusion criteria. Once more, we used consensus to settle disputes while paying careful attention to the inclusion/exclusion criteria. All studies that did not meet all of the requirements were eliminated, and their bibliographic information and the reasons for their exclusion were noted.

---

### 3. Result and discussion

Four randomized controlled trials (8–11) were considered in this systematic review analysis. Participants began either inpatient or outpatient rehabilitation programs in one study (8), inpatient pulmonary rehabilitation within two to eight days of hospital admission in another (9), and outpatient rehabilitation following inpatient treatment for an exacerbation in a third study (10). In two trials, participants underwent fairly substantial pulmonary rehabilitation (8,9), whereas in one research, individuals underwent intensive pulmonary rehabilitation (10).

Two studies provided information on readmissions to hospitals (8,10). The median follow-up length for these two investigations was eight months. According to the results of these research, pulmonary rehabilitation decreased readmissions to hospitals.

Among patients who had finished PR in the previous 12 months, according the Carr et al. trial. (8) Additionally, Carr et al. wanted to pinpoint problems that may influence the planning of more extensive multicenter trials of this treatment strategy. They postulated that QOL may be enhanced by a shortened PR regimen in comparison to standard therapy (11,12). The repeat-PR program only produced improvements in the CRQ's dyspnea domain after excluding participants who had a second COPD during the follow-up period.

The causes of limited benefits include; the timing of PR after COPD, the prevalence of moderate rather than severe COPDs, the completion of a PR program within the previous 12 months, insufficient statistical power, the different effects of COPD on the intervention and control groups, which resulted in between-group differences after randomization, or an unsuccessful repeat PR program. Despite these factors, their study, Carr et al. showed that in subjects who did not develop another COPD within three months, a shortened PR program, started after COPD that was primarily of moderate severity, produced clinically significant improvements in certain QOL domains and a significant decrease in dyspnea during daily living activities (8).

Previous research on PR after COPD has shown statistically significant improvements in many QOL dimensions, which contrasts with the Carr et al. study (11,12). The discrepancy between Carr et al. results of increases that were often too small to be statistically significant and these previous research may be due to major variations in their sample populations. First, prior findings on the benefits of PR had shown that the COPD was severe enough to necessitate hospitalization (13,14). Second, participants who were recruited in the preceding research either had undergone PR more than 12 months prior to the exacerbation or were oblivious to it (13,14).

The Eaton et al. study (9) assessed the impact of early inpatient-outpatient pulmonary rehabilitation on acute health-care utilization for patients with COPD who were admitted with an acute exacerbation. They found that early inpatient-outpatient rehabilitation was safe, feasible, and linked to non-significant trends toward shorter hospital stays, time to readmission, and COPD-related readmissions.

When community pulmonary rehabilitation was started within 10 days of discharge after an exacerbation, a randomized controlled research found that the rehabilitation group's exercise capacity and HRQL improved clinically significantly. (11) As a secondary outcome measure, acute healthcare use decreased; the rehabilitation group experienced 30% fewer readmissions and a trend toward fewer inpatient days than the standard care group, although the difference was not statistically significant. Due to the small number of participants the authors suggested doing bigger randomized investigations. Additionally, even though therapy started "early," the study ignored the possibility of further benefits from rehabilitation starting at the time of admission.

More than twice as many patients were randomized in Eaton et al. trial (9) as in the one conducted by Man et al. (28), and comparable levels of readmission and inpatient day reductions were shown, even though the results, like those of Man et al. (11) did not approach statistical significance. The fact that the trends were in the same direction may provide some encouragement. Additionally, after a month, readmissions between groups shifted in favor of the rehabilitation group. Given the nature and duration of the intervention, such disparity is conceivable from a scientific standpoint. The divergence was significantly higher for attendees, as were the disparities in other outcome measures, which further boosts confidence in the validity of the observed differences.

Given their well-established high rates of readmission and acute health care usage, it makes sense to target inpatients experiencing exacerbations of COPD. According to a previously published cost-utility analysis, pulmonary rehabilitation was both economical and beneficial to the health service for individuals with clinically stable COPD (15). The majority of COPD costs are attributed to acute health care consumption, therefore any intervention that might even slightly lower readmission rates and hospital stays would be highly desirable. The most significant gains may be anticipated during the critical first few weeks and months after admission. Although the current study's 3-month follow-up was very brief, it was ethically unacceptable to surpass the typical waiting period for rehabilitation. The benefits would have been expected to last for a longer time, and a longer follow-up might have shown even more disparity (16,17).

The "seamless transition" from inpatient rehabilitation to the outpatient treatment was a key element of the Eaton et al. study. As previously mentioned, there is a good reason for this. Physical activity is linked to a lower risk of admission, and individuals with COPD are noticeably inactive during and one month after an exacerbation (18,19). Improvements in functional ability and HRQL were shown in a randomized study of a 10-day inpatient rehabilitation program followed by six months of home training; however, the impact on acute health care utilization was not disclosed (13). Due to a lack of funding, inpatient stays longer than those necessary to treat the exacerbation itself are prohibitive in the majority of nations. The benefits of rehabilitation will naturally increase with the addition of an inpatient component, which highlights the significance of early mobilization and activity maintenance.

According to a study by Seymour et al., pulmonary rehabilitation given soon after an acute exacerbation of COPD is linked to a lower incidence of re-exacerbations that necessitate hospital admission or attendance during the next three months. Their earlier research demonstrated that this type of therapy was linked to improved exercise ability and quality of life (11). Extending these findings, their 2010 study finds that PEPR increases quadriceps muscle strength, which may, at least partially, account for the observed increase in exercise capacity.

Despite being in line with other research, Seymour et al.'s (10) hospital readmission rate was lower than what they found in their own earlier study (11). Patients with more severe COPD may have been less inclined to participate, especially those who were new to pulmonary rehabilitation, even though there was no intention to recruit less severe patients. Unlike their previous research, the Seymour et al.'s (10) study found no change in emergency department attendances that did not require admission.

The Seymour et al. study is unable to conclusively state whether the shift in healthcare utilization was caused by physiological or psychological changes brought about by the PEPR program. It is evident that during the reporting period, the majority of the patients in the PEPR group interacted with medical personnel on a regular basis. Similar to their study, a meta-analysis of less heterogeneous randomized controlled trials found a pooled OR for readmission of 0.13 (20). A combination of inpatient, outpatient, and home-based PEPR therapies were included in this meta-analysis; surprisingly, the latter did not show a decrease in readmissions.

---

#### 4. Conclusion

For individuals with COPD who have had an exacerbation, pulmonary rehabilitation is a safe strategy that enhances quality of life and exercise capability. However, it is unclear why there are different effects on hospital readmissions and mortality. Future research should examine if the impact of rehabilitation following COPD exacerbations is influenced by the scope of the program and how it is organized within particular healthcare systems.

## Compliance with ethical standards

### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

## References

- [1] Global Initiative for Chronic Obstructive Lung Disease (GOLD). From the Global Strategy for the Diagnosis, Management and Prevention of COPD, Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2016. Available from: <http://www.goldcopd.org/>
- [2] Kessler R, Ståhl E, Vogelmeier C, Haughney J, Trudeau E, Löfdahl CG, et al. Patient Understanding, Detection, and Experience of COPD Exacerbations. *Chest*. 2006 Jul;130(1):133–42. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S001236921550963X>
- [3] Aaron SD. Management and prevention of exacerbations of COPD. *BMJ*. 2014 Sep 22;349(sep22 3):g5237–g5237. Available from: <https://www.bmj.com/lookup/doi/10.1136/bmj.g5237>
- [4] SEEMUNGAL TAR, DONALDSON GC, PAUL EA, BESTALL JC, JEFFRIES DJ, WEDZICHA JA. Effect of Exacerbation on Quality of Life in Patients with Chronic Obstructive Pulmonary Disease. *Am J Respir Crit Care Med*. 1998 May 1;157(5):1418–22. Available from: <https://www.atsjournals.org/doi/10.1164/ajrccm.157.5.9709032>
- [5] Escarrabill J, Torrente E, Esquinas C, Hernández C, Monsó E, Freixas M, et al. Auditoría clínica de los pacientes que ingresan en el hospital por agudización de EPOC. Estudio MAG-1. *Arch Bronconeumol*. 2015 Oct;51(10):483–9. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0300289614003457>
- [6] Almagro P, Calbo E, Ochoa de Echagüen A, Barreiro B, Quintana S, Heredia JL, et al. Mortality After Hospitalization for COPD. *Chest*. 2002 May;121(5):1441–8. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0012369215348534>
- [7] British Thoracic Society Pulmonary Rehabilitation Guideline Group. BTS guideline on pulmonary rehabilitation in adults. *Thorax* 2013;68:S2.
- [8] Carr SJ, Hill K, Brooks D, Goldstein RS. Pulmonary Rehabilitation After Acute Exacerbation of Chronic Obstructive Pulmonary Disease in Patients Who Previously Completed a Pulmonary Rehabilitation Program. *J Cardiopulm Rehabil Prev*. 2009 Sep;29(5):318–24. Available from: <https://journals.lww.com/01273116-200909000-00009>
- [9] EATON T, YOUNG P, FERGUSON W, MOODIE L, ZENG I, O’KANE F, et al. Does early pulmonary rehabilitation reduce acute health-care utilization in COPD patients admitted with an exacerbation? A randomized controlled study. *Respirology*. 2009 Mar 25;14(2):230–8. Available from: <https://onlinelibrary.wiley.com/doi/10.1111/j.1440-1843.2008.01418.x>
- [10] Seymour JM, Moore L, Jolley CJ, Ward K, Creasey J, Steier JS, et al. Outpatient pulmonary rehabilitation following acute exacerbations of COPD. *Thorax*. 2010 May 1;65(5):423–8. Available from: <https://thorax.bmj.com/lookup/doi/10.1136/thx.2009.124164>
- [11] D-C Man W, Polkey MI, Donaldson N, Gray BJ, Moxham J. Community pulmonary rehabilitation after hospitalisation for acute exacerbations of chronic obstructive pulmonary disease: randomised controlled study. *BMJ*. 2004 Nov 20;329(7476):1209. Available from: <https://www.bmj.com/lookup/doi/10.1136/bmj.38258.662720.3A>
- [12] Behnke M, Jörres RA, Kirsten D, Magnussen H. Clinical benefits of a combined hospital and home-based exercise programme over 18 months in patients with severe COPD. *Monaldi Arch chest Dis = Arch Monaldi per le Mal del torace*. 2003;59(1):44–51. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/14533282>
- [13] BEHNKE M, TAUBE C, KIRSTEN D, LEHNIGK B, JÖRRES R, MAGNUSSEN H. Home-based exercise is capable of preserving hospital-based improvements in severe chronic obstructive pulmonary disease. *Respir Med*. 2000 Dec;94(12):1184–91. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0954611100909491>
- [14] Murphy N, Bell C, Costello RW. Extending a home from hospital care programme for COPD exacerbations to include pulmonary rehabilitation. *Respir Med*. 2005 Oct;99(10):1297–302. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0954611105000715>

- [15] Griffiths TL. Cost effectiveness of an outpatient multidisciplinary pulmonary rehabilitation programme. *Thorax*. 2001 Oct 1;56(10):779–84. Available from: <https://thorax.bmj.com/lookup/doi/10.1136/thorax.56.10.779>
- [16] Cote CG, Celli BR. Pulmonary rehabilitation and the BODE index in COPD. *Eur Respir J*. 2005 Oct;26(4):630–6. Available from: <http://publications.ersnet.org/lookup/doi/10.1183/09031936.05.00045505>
- [17] Griffiths T, Burr M, Campbell I, Lewis-Jenkins V, Mullins J, Shiels K, et al. Results at 1 year of outpatient multidisciplinary pulmonary rehabilitation: a randomised controlled trial. *Lancet*. 2000 Jan;355(9201):362–8. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0140673699070427>
- [18] Pitta F, Troosters T, Probst VS, Spruit MA, Decramer M, Gosselink R. Physical Activity and Hospitalization for Exacerbation of COPD. *Chest*. 2006 Mar;129(3):536–44. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S0012369215522526>
- [19] Garcia-Aymerich J, Lange P, Benet M, Schnohr P, Anto JM. Regular physical activity reduces hospital admission and mortality in chronic obstructive pulmonary disease: a population based cohort study. *Thorax*. 2006 Sep 1;61(9):772–8. Available from: <https://thorax.bmj.com/lookup/doi/10.1136/thx.2006.060145>
- [20] Puhan MA, Gimeno-Santos E, Scharplatz M, Troosters T, Walters EH, Steurer J. Pulmonary rehabilitation following exacerbations of chronic obstructive pulmonary disease. In: Puhan MA, editor. *Cochrane Database of Systematic Reviews*. Chichester, UK: John Wiley & Sons, Ltd; 2011. Available from: <https://doi.wiley.com/10.1002/14651858.CD005305.pub3>