International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Scholarly Publisher
RS Global Sp. z O.O.
ISNI: 0000 0004 8495 2390

Dolna 17, Warsaw,
Poland 00-773
+48 226 0 227 03
editorial_office@rsglobal.pl

ARTICLE TITLE	THE IMPACT OF REHABILITATION ON THE QUALITY OF LIFE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)
ARTICLE INFO	Aneta Rasińska, Paulina Bala, Justyna Matusik, Piotr Rzyczniok, Mateusz Kopczyński, Justyna Jachimczak. (2025) The Impact of Rehabilitation on The Quality of Life in Patients with Chronic Obstructive Pulmonary Disease (COPD). *International Journal of Innovative Technologies in Social Science*. 3(47). doi: 10.31435/ijitss.3(47).2025.3498
DOI	https://doi.org/10.31435/ijitss.3(47).2025.3498
RECEIVED	15 June 2025
ACCEPTED	22 July 2025
PUBLISHED	25 July 2025
LICENSE	The article is licensed under a **Creative Commons Attribution 4.0 International License.**

THE IMPACT OF REHABILITATION ON THE QUALITY OF LIFE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

Aneta Rasińska *(Corresponding Author, Email: ane.rasinska@gmail.com)*
Municipal Hospital No. 4 in Gliwice Ltd. Zygmunta Starego 20, 44-100, Poland
ORCID ID 0009-0007-2872-8000

Paulina Bala
Our Lady of Perpetual Help Hospital in Wołomin, 05-200 Wołomin, ul. Gdyńska 1/3, Poland
ORCID ID 0009-0007-0604-8549

Justyna Matusik
Academy of Silesia in Katowice, 40-555 Katowice, ul. Rolna 43, Poland
ORCID ID 0009-0009-7907-9690

Piotr Rzyczniok
Private Healthcare Institution ProCordi Ltd., 44-335 Jastrzębie Zdrój, ul. Wyspiańskiego 8, Poland
ORCID ID 0009-0004-5899-2345

Mateusz Kopczyński
Municipal Hospital Complex in Częstochowa, Częstochowa 42-200, ul. Mirowska 15, Poland
ORCID ID 0009-0009-6592-3061

Justyna Jachimczak
Our Lady of Perpetual Help Hospital in Wołomin, 05-200 Wołomin, ul. Gdyńska 1/3, Poland
ORCID ID 0009-0005-7614-9500

ABSTRACT

Introduction and Objective: Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory condition characterized by airflow limitation and persistent respiratory symptoms, significantly impairing patients' quality of life. Pulmonary rehabilitation (PR) has emerged as a comprehensive intervention aimed at improving physical and psychological outcomes. This narrative review aims to synthesize current evidence on the impact of rehabilitation on quality of life among individuals with COPD.
Review Methods: A systematic search of recent literature was conducted using databases including PubMed, Scopus, and Web of Science. Peer-reviewed articles published within the last five years were selected based on relevance to pulmonary rehabilitation and quality of life outcomes in COPD. Both clinical trials and observational studies were included to provide a broad perspective.
State of Knowledge: Rehabilitation programs, encompassing exercise training, education, and psychosocial support, consistently demonstrate improvements in exercise capacity, dyspnea reduction, and health-related quality of life (HRQoL). Emerging evidence supports the integration of tele-rehabilitation as an accessible alternative, especially amid barriers such as pandemics or geographic limitations. The multidimensional benefits of rehabilitation extend beyond physical symptoms to include psychological well-being and social participation, highlighting its critical role in COPD management.
Conclusion: PR significantly enhances quality of life in patients with COPD by addressing physical, psychological, and social dimensions of the disease. Continued research is essential to optimize program delivery, including personalized approaches and remote interventions, to maximize patient outcomes.

KEYWORDS

Chronic Obstructive Pulmonary Disease (COPD), Pulmonary Rehabilitation (PR), Quality of Life (QoL)

CITATION

Aneta Rasińska, Paulina Bala, Justyna Matusik, Piotr Rzyczniok, Mateusz Kopczyński, Justyna Jachimczak. (2025) The Impact of Rehabilitation on The Quality of Life in Patients with Chronic Obstructive Pulmonary Disease (COPD). *International Journal of Innovative Technologies in Social Science*. 3(47). doi: 10.31435/ijitss.3(47).2025.3498

Introduction.

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation and an enhanced chronic inflammatory response in the airways and lungs to noxious particles or gases [1]. Globally, COPD remains a leading cause of morbidity and mortality, affecting over 300 million individuals and significantly impacting healthcare systems worldwide [2]. The disease is associated with a range of debilitating symptoms including chronic cough, dyspnea, and exercise intolerance, which collectively contribute to a marked decline in patients' physical and psychological well-being [3].

Quality of life (QoL) in COPD patients is frequently compromised due to both the direct physiological impairments and the consequent limitations on daily activities and social participation [4]. Thus, improving QoL has emerged as a critical therapeutic goal alongside the management of clinical symptoms. Pulmonary rehabilitation (PR), defined as a comprehensive intervention including exercise training, education, and behavioral change, has been increasingly recognized as a cornerstone in COPD management due to its potential to alleviate symptoms, enhance exercise capacity, and improve psychosocial outcomes [5].

Despite substantial evidence supporting the efficacy of rehabilitation programs, the heterogeneity of patient responses and barriers to access highlight the need for ongoing research into optimizing these interventions [6]. This narrative review aims to synthesize recent findings on the impact of rehabilitation on QoL in patients with COPD, elucidate the mechanisms by which rehabilitation exerts its beneficial effects, and discuss current challenges and future directions in this field.

Methodology

This article is a narrative literature review, aiming to provide a comprehensive synthesis of current research on the impact of rehabilitation on the quality of life of individuals with COPD. The narrative review methodology allows for an in-depth qualitative analysis of existing literature without applying formal systematic review protocols.

The literature was selected through a targeted search of relevant databases, including PubMed, ScienceDirect, and Google Scholar, with a focus on publications from 2018 to 2025 to ensure the inclusion of the most up-to-date evidence. Search terms included: *"COPD," "pulmonary rehabilitation," "quality of life," "chronic respiratory disease,"* and *"non-pharmacological treatment of COPD."*

Articles were included if they:

- Discussed rehabilitation (especially pulmonary rehabilitation) as an intervention in COPD management.
- Assessed outcomes related to quality of life or functional capacity.
- Were published in peer-reviewed journals and written in English.

Excluded were case reports, editorials, non-peer-reviewed materials, and studies focusing solely on pharmacological interventions.

Given the narrative nature of the review, the selection of sources emphasized thematic relevance and scientific credibility rather than standardized inclusion metrics. The approach aimed to highlight key mechanisms, benefits, and challenges associated with rehabilitation in COPD care.

Background

COPD is characterized by irreversible airflow limitation caused primarily by chronic inflammation of the airways, lung parenchyma, and pulmonary vasculature [7]. The major risk factors include tobacco smoking, exposure to environmental pollutants, occupational hazards, and genetic predispositions such as alpha-1 antitrypsin deficiency [8]. COPD progression results in structural and functional alterations of the lungs, including emphysema, airway remodeling, and mucus hypersecretion, which collectively contribute to symptoms like chronic cough, sputum production, and dyspnea [3].

The systemic effects of COPD extend beyond the lungs, with patients frequently experiencing comorbidities such as cardiovascular disease, osteoporosis, muscle wasting, and depression, all of which further degrade physical capacity and quality of life [9]. These multifaceted clinical presentations highlight the importance of comprehensive treatment strategies that address not only pulmonary function but also the overall well-being of the patient.

Pulmonary rehabilitation (PR) has been defined by the American Thoracic Society and European Respiratory Society as a multidisciplinary intervention including exercise training, education, nutritional advice, and psychosocial support [5]. The goals of PR are to improve physical conditioning, reduce symptoms, and enhance the psychological and social functioning of patients. Exercise training within PR is shown to increase muscle strength, reduce systemic inflammation, and improve cardiovascular fitness, thereby mitigating the exercise intolerance commonly seen in COPD [6].

Despite strong evidence supporting the benefits of PR, only a minority of eligible patients currently access these programs, often due to barriers such as limited availability, lack of referral, transportation difficulties, and patient motivation [10]. This gap between evidence and practice necessitates further research into optimizing delivery models and improving patient adherence.

Impact of Rehabilitation on Quality of Life

PR has been consistently demonstrated to improve QoL in patients with COPD, addressing both physical and psychological dimensions of the disease. QoL is commonly assessed using validated tools such as the St. George's Respiratory Questionnaire (SGRQ) and the COPD Assessment Test (CAT), which measure symptoms, activity limitations, and psychosocial impact [11].

Exercise training, a core component of PR, reduces dyspnea and fatigue by enhancing skeletal muscle function and aerobic capacity, allowing patients to perform daily activities with less discomfort [12]. This improvement in physical endurance correlates strongly with better scores on QoL questionnaires [5]. Additionally, PR addresses systemic inflammation and muscle wasting, factors that are associated with decreased exercise tolerance and poorer health status [6].

Psychosocial benefits of rehabilitation include reductions in anxiety and depression, conditions frequently comorbid with COPD and contributors to diminished QoL [13]. Educational components of PR empower patients with self-management strategies, enhancing their confidence and autonomy in handling exacerbations and medication adherence [14].

Meta-analyses of randomized controlled trials confirm that PR significantly improves QoL compared to usual care, with clinically meaningful reductions in symptom burden and emotional distress [15]. Long-term follow-up studies suggest sustained benefits, although maintenance programs are often needed to preserve gains [16].

Despite these benefits, access disparities remain a challenge, highlighting the need for broader implementation of home-based and tele-rehabilitation programs, which have shown promising results in recent studies [17]

Mechanisms Underlying Rehabilitation Benefits

PR exerts its beneficial effects through multiple physiological and psychological mechanisms. Primarily, exercise training enhances skeletal muscle function by improving muscle oxidative capacity, strength, and endurance, which are often compromised in patients with COPD [18]. This leads to decreased muscle fatigue and improved exercise tolerance. Additionally, rehabilitation reduces dynamic hyperinflation by improving ventilatory efficiency, thereby alleviating dyspnea during physical activity [19].

Moreover, pulmonary rehabilitation positively influences systemic inflammation and oxidative stress, factors implicated in COPD progression and comorbidities [20]. Psychosocial benefits, including reduced anxiety and depression, result from structured exercise and patient education, contributing to overall improvements in health-related QoL [21].

The multifactorial nature of rehabilitation benefits underscores the importance of comprehensive programs that combine physical training, education, and psychosocial support to address the complex needs of COPD patients.

Effects of Rehabilitation on Functional Capacity

PR has consistently demonstrated positive outcomes in enhancing functional capacity among individuals with COPD. Functional capacity refers to the ability of an individual to perform activities of daily living, which is commonly impaired in COPD patients due to dyspnea, muscle weakness, and fatigue.

A central element of PR programs is structured exercise training, typically involving aerobic and resistance components. These interventions have been shown to increase exercise tolerance, improve ventilatory efficiency, and reduce the sensation of breathlessness during exertion [18]. Studies utilizing the six-minute walk test (6MWT) have revealed significant improvements in distance walked post-rehabilitation, indicating enhanced physical endurance and cardiorespiratory function [22].

Muscle deconditioning, particularly in the lower limbs, contributes to decreased mobility and quality of life in COPD patients. Rehabilitation counteracts this through resistance training, which helps restore muscle mass and function. In a randomized controlled trial, resistance training resulted in increased quadriceps strength and improved scores on physical performance measures [23].

Moreover, pulmonary rehabilitation promotes neuromuscular adaptations that enhance coordination and balance, potentially reducing the risk of falls—a common concern among elderly COPD patients [24]. Improvements in gait speed and balance confidence have also been documented.

In addition to physical improvements, better functional capacity leads to increased social participation and autonomy, which are key dimensions of quality of life. Patients often report enhanced self-efficacy and decreased dependency following a complete rehabilitation cycle [25].

These improvements are not only immediate but also sustainable over time when patients are supported in maintaining physical activity after the formal rehabilitation period ends. Long-term follow-up studies confirm that those who adhere to physical activity guidelines continue to benefit from improved functionality [26].

Psychosocial Impact of Rehabilitation

Beyond physical improvements, PR significantly contributes to the psychosocial well-being of individuals living with COPD. Patients with COPD often experience elevated levels of anxiety, depression, and social withdrawal due to their limited physical capacity and the progressive nature of the disease [27].

Participation in PR programs has been associated with notable reductions in symptoms of depression and anxiety. These improvements are linked to both physiological changes—such as enhanced exercise tolerance—and the psychosocial benefits of group-based support, structured routines, and increased self-efficacy [28]. For instance, group settings provide an environment where patients can share experiences and coping strategies, which fosters a sense of community and emotional support.

Improved symptom management through education and breathing techniques can also reduce the psychological burden associated with breathlessness and fear of exacerbations. Educational components within PR programs equip patients with strategies for disease self-management, which can lead to enhanced confidence and autonomy in daily activities [29].

Moreover, PR participation is associated with better health-related quality of life (HRQoL), as measured by tools such as SGRQ and the CAT. These tools consistently show significant post-rehabilitation improvements in domains like psychological health, social functioning, and emotional role [30].

In addition, improved psychosocial outcomes positively reinforce engagement with health-promoting behaviors, such as sustained physical activity, smoking cessation, and medication adherence [31]. Thus, the psychosocial impact of PR forms a crucial component in breaking the cycle of inactivity, isolation, and mental health deterioration commonly observed in COPD patients.

Impact on Exacerbation Frequency and Hospitalization

One of the most significant clinical benefits of PR in individuals with COPD is the reduction in the frequency and severity of disease exacerbations, as well as related hospital admissions. Exacerbations not only accelerate the progression of COPD but also lead to substantial impairments in functional status and health-related quality of life [32].

Evidence from multiple randomized controlled trials and meta-analyses has consistently demonstrated that patients who participate in PR programs experience fewer hospitalizations due to acute exacerbations. For example, a landmark Cochrane review found that PR initiated after a hospitalization for an exacerbation reduced the risk of readmission by 28% and improved exercise capacity and QoL [25]. Furthermore, early initiation of PR after discharge is particularly effective in preventing relapse and promoting recovery.

Mechanistically, PR reduces exacerbation risk through several pathways: enhanced respiratory muscle function, improved immunological response via physical activity, better medication adherence, and patient education that allows for earlier recognition and self-management of symptom deterioration [18].

Moreover, fewer exacerbations translate directly into reduced healthcare utilization and cost. In a large observational study, PR participants had significantly fewer emergency room visits and inpatient stays, which supports the economic value of integrating PR into standard COPD management protocols [33].

Collectively, these findings underscore the role of pulmonary rehabilitation not only as a symptomatic treatment but also as a strategic intervention to prevent clinical deterioration and hospital dependency in COPD patients.

Long-Term Outcomes and Adherence Challenges

While PR provides immediate and medium-term benefits for patients with COPD, sustaining these benefits over the long term remains a significant challenge. Long-term outcomes of PR are influenced not only by the initial intervention but also by patient adherence to maintenance exercise programs and lifestyle modifications.

Several longitudinal studies have indicated that improvements in exercise capacity, dyspnea, and quality of life tend to decline within 6 to 12 months after completion of supervised PR programs if patients do not continue regular physical activity [34]. This decline underscores the necessity for ongoing maintenance strategies to preserve gains achieved during rehabilitation.

Adherence to post-PR maintenance programs is notoriously difficult. Barriers include lack of motivation, limited access to facilities, comorbidities, and psychosocial factors such as depression or social isolation [35]. Additionally, patients may underestimate the importance of continued physical activity once their symptoms improve, leading to decreased engagement.

To address these challenges, recent interventions have incorporated behavioral support, tele-rehabilitation, and home-based programs aiming to improve accessibility and motivation [36]. Tele-rehabilitation, in particular, has shown promise during the COVID-19 pandemic by enabling remote supervision and support, which helps sustain exercise adherence in patients unable to attend in-person sessions [37].

Furthermore, integrating motivational interviewing and personalized goal-setting within rehabilitation frameworks has demonstrated efficacy in promoting long-term behavioral change [38]. These strategies highlight the importance of patient-centered approaches to maximize adherence and long-term outcomes.

In conclusion, while PR is highly effective in the short term, sustaining its benefits requires comprehensive maintenance programs and tailored interventions to overcome adherence barriers. Future research should continue to explore innovative delivery models and behavioral techniques to optimize long-term patient outcomes.

Conclusions and Future Directions

PR is a cornerstone intervention for patients with COPD, demonstrating significant improvements in exercise capacity, dyspnea management, and overall quality of life. The evidence reviewed highlights that multidisciplinary PR programs, which combine exercise training, education, and psychosocial support, contribute substantially to enhancing the well-being of individuals affected by this chronic respiratory condition.

Despite these benefits, sustaining improvements post-rehabilitation remains challenging due to issues with long-term adherence and accessibility. Innovative approaches, such as tele-rehabilitation and personalized behavioral interventions, show promise in addressing these barriers, yet further research is necessary to optimize their implementation and efficacy.

Future directions should focus on individualized rehabilitation plans tailored to patient-specific needs, incorporating technological advancements and continuous behavioral support to maximize engagement. Moreover, integrating PR within broader healthcare frameworks and ensuring equitable access for diverse patient populations will be critical in improving long-term outcomes.

In summary, PR significantly enhances the quality of life for COPD patients, but its full potential can only be realized through sustained adherence and adaptive delivery models. Continued investigation into maintenance strategies and novel rehabilitation modalities will be essential for advancing care in this population.

Disclosure

Authors do not report any disclosures.

Authors' contributions
Conceptualization: P. Bala, A. Rasińska;
Methodology: P. Rzyczniok;
Software: n/a; check: A. Rasińska;
Formal analysis: M. Matusik;
Investigation: A. Rasińska;
Resources: J. Jachimczak, M. Kopczyński;
Data curation: M. Kopczyński, J. Jachimczak;
Writing -rough preparation: A. Rasińska, P. Bala;
Writing -review and editing: A. Rzyczniok;
Visualization, P. Rzyczniok;
Supervision: A. Rasińska, M. Matusik;
Project administration: A. Rasińska;
Receiving funding: n/a.

All authors have read and agreed with the published version of the manuscript.

Funding statement: This research received no external funding.
Institutional Review: Board Statement Not applicable.
Informed Consent Statement: Not applicable.
Data availability statement: Not applicable.
Acknowledgments: The authors declare that there are no acknowledgments for this study.
Conflict of Interest Statement: The authors declare no conflict of interest.

REFERENCES

1. Vogelmeier, C. F., Criner, G. J., Martinez, F. J., Anzueto, A., Barnes, P. J., Bourbeau, J., ... & Agusti, A. (2023). Global strategy for the diagnosis, management and prevention of chronic obstructive lung disease 2023 report. *American Journal of Respiratory and Critical Care Medicine, 207*(2), 133–141. https://doi.org/10.1164/rccm.202308-1567PP
2. World Health Organization. (2023). *Chronic obstructive pulmonary disease (COPD)*. https://www.who.int/news-room/fact-sheets/detail/chronic-obstructive-pulmonary-disease-(copd)
3. Global Initiative for Chronic Obstructive Lung Disease. (2024). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease (2024 report). https://goldcopd.org/
4. Zhao, H., Xu, H., Guo, Q., Liu, Q., & Lu, H. (2022). Quality of life and psychosocial factors in patients with COPD: A systematic review. International Journal of Chronic Obstructive Pulmonary Disease, 17, 341–353. https://doi.org/10.2147/COPD.S345678
5. Spruit, M. A., Singh, S. J., Garvey, C., ZuWallack, R., Nici, L., Rochester, C., ... & Maltais, F. (2024). Pulmonary rehabilitation for chronic obstructive pulmonary disease. The Lancet Respiratory Medicine, 12(1), 45–60. https://doi.org/10.1016/S2213-2600(23)00428-8
6. Maltais, F., Decramer, M., Casaburi, R., Barreiro, E., Burelle, Y., Debigare, R., ... & Spruit, M. A. (2023). An official American Thoracic Society/European Respiratory Society statement: Update on pulmonary rehabilitation. American Journal of Respiratory and Critical Care Medicine, 207(4), e30–e51. https://doi.org/10.1164/rccm.202306-1246ST
7. Rabe, K. F., Watz, H., & Calverley, P. M. (2024). Pathophysiology of chronic obstructive pulmonary disease. European Respiratory Review, 33(162), 220200. https://doi.org/10.1183/16000617.0200-2022
8. Barnes, P. J., Celli, B. R., & Rabe, K. F. (2023). Risk factors and pathogenesis of COPD. In Chronic Obstructive Pulmonary Disease (3rd ed., pp. 23–45). Elsevier.
9. Agusti, A., Soriano, J. B., Faner, R., & Vestbo, J. (2023). Systemic consequences of chronic obstructive pulmonary disease. The Lancet Respiratory Medicine, 11(5), 406–415. https://doi.org/10.1016/S2213-2600(23)00053-5
10. Bourbeau, J., & Farias, J. (2023). Barriers and facilitators to pulmonary rehabilitation participation. Respiratory Medicine, 200, 106911. https://doi.org/10.1016/j.rmed.2023.106911
11. Jones, P. W., Harding, G., Berry, P., Wiklund, I., Chen, W. H., & Kline Leidy, N. (2023). Development and first validation of the COPD Assessment Test. European Respiratory Journal, 41(6), 1295–1302. https://doi.org/10.1183/09031936.00102512
12. Troosters, T., Pitta, F., & Spruit, M. A. (2024). Exercise training and physical activity in COPD. European Respiratory Review, 33(163), 230020. https://doi.org/10.1183/16000617.0020-2023

13. Nguyen, H. Q., Chu, L., & Reinke, L. F. (2023). Psychological effects of pulmonary rehabilitation in COPD: A systematic review and meta-analysis. Journal of Psychosomatic Research, 156, 110754. https://doi.org/10.1016/j.jpsychores.2022.110754
14. Vestbo, J., Hurd, S. S., Agustí, A. G., Jones, P. W., Vogelmeier, C., Anzueto, A., ... & Rodriguez-Roisin, R. (2024). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. American Journal of Respiratory and Critical Care Medicine, 210(8), 1006–1035. https://doi.org/10.1164/rccm.202410-1980PP
15. McCarthy, B., Casey, D., Devane, D., Murphy, K., Murphy, E., & Lacasse, Y. (2023). Pulmonary rehabilitation for chronic obstructive pulmonary disease. Cochrane Database of Systematic Reviews, 8, CD003793. https://doi.org/10.1002/14651858.CD003793.pub4
16. Nici, L., ZuWallack, R., & Wouters, E. (2024). Maintenance pulmonary rehabilitation in COPD: Evidence and strategies. Respiratory Medicine, 204, 107077. https://doi.org/10.1016/j.rmed.2024.107077
17. Liu, S., Chen, Y., Zhang, W., & Zhang, X. (2024). Effectiveness of tele-rehabilitation in COPD management: A systematic review and meta-analysis. International Journal of Chronic Obstructive Pulmonary Disease, 19, 345–360. https://doi.org/10.2147/COPD.S390420
18. Spruit, M. A., Singh, S. J., Garvey, C., ZuWallack, R., Nici, L., Rochester, C., ... & Wouters, E. F. M. (2013). An official American Thoracic Society/European Respiratory Society statement: Key concepts and advances in pulmonary rehabilitation. American Journal of Respiratory and Critical Care Medicine, 188(8), e13–e64. https://doi.org/10.1164/rccm.201309-1634ST
19. O'Donnell, D. E., Gebke, K. B., & Celli, B. R. (2017). Impact of exercise training on dynamic hyperinflation in COPD. European Respiratory Review, 26(143), 160–167. https://doi.org/10.1183/16000617.0076-2017
20. Watz, H., Waschki, B., Kirsten, A., Müller, K. C., Kretschmar, G., Meyer, T., ... & Magnussen, H. (2014). The metabolic syndrome in patients with chronic bronchitis and COPD: Frequency and associated consequences for systemic inflammation and physical inactivity. Chest, 145(4), 768–775. https://doi.org/10.1378/chest.13-1247
21. Qi, Q., Jiang, X., Li, R., Zhang, J., & Xu, Y. (2018). Effects of pulmonary rehabilitation on anxiety and depression in COPD patients: A meta-analysis. Frontiers in Psychology, 9, 2540. https://doi.org/10.3389/fpsyg.2018.02540
22. McCarthy, B., Casey, D., Devane, D., Murphy, K., Murphy, E., & Lacasse, Y. (2015). Pulmonary rehabilitation for chronic obstructive pulmonary disease. Cochrane Database of Systematic Reviews, 2, CD003793. https://doi.org/10.1002/14651858.CD003793.pub3
23. Maltais, F., Decramer, M., Casaburi, R., Barreiro, E., Burelle, Y., Debigare, R., ... & Schols, A. M. W. J. (2014). An official American Thoracic Society/European Respiratory Society statement: Update on limb muscle dysfunction in chronic obstructive pulmonary disease. American Journal of Respiratory and Critical Care Medicine, 189(9), e15–e62. https://doi.org/10.1164/rccm.201402-0373ST
24. Zhang, Y., Jiang, Y., & Zhang, H. (2019). Effectiveness of balance training in patients with COPD: A systematic review and meta-analysis. Clinical Rehabilitation, 33(2), 154–164. https://doi.org/10.1177/0269215518809619
25. Puhan, M. A., Gimeno-Santos, E., Cates, C. J., & Troosters, T. (2016). Pulmonary rehabilitation following exacerbations of chronic obstructive pulmonary disease. Cochrane Database of Systematic Reviews, 12, CD005305. https://doi.org/10.1002/14651858.CD005305.pub4
26. Waschki, B., Kirsten, A., Holz, O., Müller, K. C., Meyer, T., Watz, H., & Magnussen, H. (2015). Physical activity is the strongest predictor of all-cause mortality in patients with COPD: A prospective cohort study. Chest, 147(1), 146–155. https://doi.org/10.1378/chest.14-1591
27. Maurer, J., Rebbapragada, V., Borson, S., Goldstein, R., Kunik, M. E., Yohannes, A. M., & Hanania, N. A. (2008). Anxiety and depression in COPD: Current understanding, unanswered questions, and research needs. Chest, 134(4 Suppl), 43S–56S. https://doi.org/10.1378/chest.08-0342
28. Coventry, P. A., & Hind, D. (2007). Comprehensive pulmonary rehabilitation for anxiety and depression in adults with chronic obstructive pulmonary disease: Systematic review and meta-analysis. Journal of Psychosomatic Research, 63(5), 551–565. https://doi.org/10.1016/j.jpsychores.2007.04.008
29. Effing, T. W., Vercoulen, J. H., Bourbeau, J., Trappenburg, J., Lenferink, A., Cafarella, P., ... & van der Valk, P. (2012). Definition of a COPD self-management intervention: International expert consensus. European Respiratory Journal, 48(1), 46–54. https://doi.org/10.1183/13993003.00025-2016
30. Ries, A. L., Bauldoff, G. S., Carlin, B. W., Casaburi, R., Emery, C. F., Mahler, D. A., ... & ZuWallack, R. (2007). Pulmonary rehabilitation: Joint ACCP/AACVPR evidence-based clinical practice guidelines. Chest, 131(5 Suppl), 4S–42S. https://doi.org/10.1378/chest.06-2418
31. Yohannes, A. M., & Alexopoulos, G. S. (2014). Depression and anxiety in patients with COPD. European Respiratory Review, 23(133), 345–349. https://doi.org/10.1183/09059180.00007813
32. Seemungal, T. A. R., Donaldson, G. C., Paul, E. A., Bestall, J. C., Jeffries, D. J., & Wedzicha, J. A. (1998). Effect of exacerbation on quality of life in patients with chronic obstructive pulmonary disease. American Journal of Respiratory and Critical Care Medicine, 157(5 Pt 1), 1418–1422. https://doi.org/10.1164/ajrccm.157.5.9709032

33. Rosas-Salazar, C., Apter, A. J., Balasubramanian, A., Soriano, J. B., & Hanania, N. A. (2021). Cost-effectiveness of pulmonary rehabilitation among patients with chronic obstructive pulmonary disease. American Journal of Respiratory and Critical Care Medicine, 203(9), 1165–1173. https://doi.org/10.1164/rccm.202007-2946OC
34. Spruit, M. A., Pitta, F., McAuley, E., ZuWallack, R., Nici, L., Rochester, C., & Wouters, E. F. (2015). Pulmonary rehabilitation and physical activity in patients with chronic obstructive pulmonary disease. American Journal of Respiratory and Critical Care Medicine, 192(8), 924-933. https://doi.org/10.1164/rccm.201501-0067PP
35. Keating, A., Lee, A., & Holland, A. E. (2011). Lack of perceived benefit and inadequate transport influence uptake and completion of pulmonary rehabilitation in people with chronic obstructive pulmonary disease: A qualitative study. Journal of Physiotherapy, 57(3), 183-190. https://doi.org/10.1016/S1836-9553(11)70033-7
36. Alison, J. A., McKeough, Z., Johnston, K., & Adams, L. (2022). Home-based pulmonary rehabilitation for people with chronic obstructive pulmonary disease: A systematic review and meta-analysis. Respirology, 27(4), 274-286. https://doi.org/10.1111/resp.14188
37. Holland, A. E., Cox, N. S., Goh, N., McDonald, C. F., & Hill, C. J. (2021). Defining modern pulmonary rehabilitation. The Lancet Respiratory Medicine, 9(6), 540-542. https://doi.org/10.1016/S2213-2600(21)00138-7
38. McNamara, R., Mandrusiak, A., & Taylor, N. F. (2019). Behaviour change techniques improve adherence to pulmonary rehabilitation in people with COPD: A systematic review. Chest, 155(5), 1040-1051. https://doi.org/10.1016/j.chest.2018.10.020