

## Review Article

# Types of physical activities and exercise interventions in the management of chronic obstructive pulmonary disease

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## ABSTRACT

Chronic obstructive pulmonary disease (COPD), also known as pulmonary disease, is a long-term lung disease condition characterized by inflammation that leads to restricted airflow from the lungs. People with COPD may experience symptoms like coughing, mucus production, wheezing, feeling tightness in the chest, being tired or losing weight unintentionally, and experiencing swelling. COPD can also lead to episodes of worsened symptoms called exacerbations that require attention. The severity of COPD is categorized into four stages ranging from mild to severe based on how it limits airflow in the lungs. COPD management requires a comprehensive and personalized approach that considers various factors that influence the condition. In this review, we searched the existing body of research regarding how exercise interventions can help manage COPD. These interventions include rehabilitation, aerobic exercise, resistance exercise, and inspiratory muscle training. The goal of these interventions is to enhance exercise capacity, alleviate breathlessness, improve fitness, boost muscle strength, and enhance functionality and quality of life for individuals living with COPD. The paper also discusses the pharmacological therapy and dietary support that are essential for COPD management. The review states that COPD is an advancing illness that necessitates detection and efficient intervention methods, in order to reduce its advancement and enhance its results. The paper emphasizes the significance of integrating exercise interventions into COPD treatment as a means to encourage activity and overall wellness among patients with COPD.

**Keywords:** COPD management, Exercise interventions, Pulmonary rehabilitation, Physical activity COPD, Respiratory health

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common inflammatory lung disease that causes reduced physical activity (PA) and increased mortality.<sup>1</sup> PA is the strongest predictor of survival in COPD patients.<sup>2</sup> Hence

it's crucial to have a grasp of the scenario, in the field of pulmonary rehabilitation (PR) the obstacles and factors that aid it as well as the assessment instruments employed for individuals, with COPD. According to a scoping review by Xiang et al main barriers to PA in COPD patients are older age, women, lung function,

comorbidities, COPD symptoms (fear of breathlessness and injury, severe fatigue, anxiety and depression), GOLD stage, frequency of exacerbation, oxygen use, lack of motivation and environment-related factors (e.g., season and weather).<sup>1</sup> Social support, self-belief, having a mindset, and having access to resources are the key factors that mainly help in promoting physical activity (PA).<sup>3-5</sup> Various studies have examined the impact of interventions involving exercise on PA. Have found significant positive effects on patient's prognosis. However, these studies also highlighted the challenges of sustaining PA in real-life settings. They recommended research to determine the effective tools, for measuring PA and to assess the long-term effectiveness of interventions aimed at promoting behavioral change.

A private care system like “The Cleveland Clinic” provides some guidelines for exercise and PR for COPD patients. PR is a program that incorporates techniques, for improving breathing exercise training providing education, and offering counseling.<sup>6</sup> Its purpose is to enhance the quality of life for individuals, with COPD while alleviating symptoms. The types of exercise recommended for COPD patients are stretching, cardiovascular or aerobic, and strengthening. Stretching can improve flexibility and range of motion. Cardiovascular or aerobic exercise can improve circulation, oxygen use, heart function, endurance, blood pressure, muscle tone, and stress. Strengthening exercise can increase the strength of respiratory muscles and bones.<sup>6-8</sup> The frequency of exercise depends on the individual's condition and tolerance. The intensity of exercise should be moderate to vigorous, but not cause excessive breathlessness or fatigue.

The American Lung Association identified the significance of engaging in activity, for individuals with COPD.<sup>9</sup> They emphasize that regular exercise can play a role in preventing complications, like blood clots, weight gain, muscle loss, depression, and osteoporosis.<sup>10,11</sup> The association also provides some tips to exercise safely with COPD, including warming up and cooling down properly using a bronchodilator before exercising staying hydrated avoiding temperatures and air pollution monitoring symptoms and heart rate closely taking rest when needed, and seeking medical advice whenever necessary. The primary aim of this study is to examine the existing research to review the exercise intervention, for the management of pulmonary disease (COPD).

## LITERATURE SEARCH

On September 6, 2023, we conducted a search, in databases including Medline, PubMed, and Scopus to gather relevant literature. Our search focused on finding information about the role of activity and exercise interventions in managing COPD. To broaden our search, we also explored Google Scholar using the keywords. Examined the citations of selected articles. We specifically looked for articles published in English

between 2009 and 2023 that presented research or systematic reviews/meta-analyses involving participants with COPD. Additionally, we only included articles that measured one outcome related to activity or exercise interventions. We excluded non peer-reviewed articles, in vitro studies, those without abstracts or full texts available as well, as those of low quality or high risk of bias. After screening the titles and abstracts of our retrieved articles we carefully selected ones for our review.

## DISCUSSION

Lifestyle, including physical inactivity in daily life, could play a positive role in terms of the probability of happening life-threatening issues during disability and mortality. The key important fact is that regular physical activity may help to prevent or delay the onset or progress of different chronic diseases which are now well-recognized worldwide.<sup>12-14</sup> Considering examples like studies showing that individuals with pulmonary disease (COPD) who engage in less physical activity throughout their daily lives face an increased likelihood of hospital readmission and a shorter overall survival. Hence it is crucial to evaluate the quantity and intensity of activity in one's routine due to the strong correlation between activity levels and overall well-being.

### *Clinical manifestation*

COPD, which stands for pulmonary disease, encompasses a range of lung conditions that hinder airflow and make it challenging to breathe. COPD is a condition that can manifest in forms. Bronchitis and emphysema are two of the encountered forms of COPD.<sup>15</sup> A recent study discovered that 24 million adults, in the United States show signs of impaired lung function, which's an indication of COPD. Furthermore, the study uncovered that, over 14% of adult's experience bronchitis while 11% have emphysema and 9% are affected by both conditions. The prevalent signs of COPD typically involve coughing, producing sputum, and experiencing shortness of breath during activity. These symptoms may arise from a variety of diverse etiologies, and therefore the diagnosis of COPD requires confirmation with spirometry. In most cases, COPD often goes unnoticed until significant harm has already occurred in the lungs. As it advances the symptoms tend to worsen especially if the person continues to be exposed to smoking or other harmful factors in their environment.<sup>16,17</sup> COPD can display a variety of signs and symptoms with one of its indicators being difficulty breathing during physical exertion. Patients often find that even routine tasks become more challenging as their breathing becomes labored. Wheezing is another most common symptom that is characterized by a high-pitched whistling sound when breathing, indicative of narrowed airways. This can be accompanied by chest tightness, which contributes to the sensation of breathlessness. A chronic cough is often a persistent feature of COPD. Sometimes when an individual cough they might expel a substance called

sputum, which can have colors, like white, yellow, or even a bit greenish. The presence of sputum is a reflection of ongoing irritation and inflammation within the airways.

Frequent respiratory infections can also be part of the COPD experience. The compromised lung function in COPD makes individuals more susceptible to infections, which can exacerbate their symptoms. Many individuals who have COPD often mention feeling lacking energy.<sup>1,18</sup> This can be attributed to the increased effort required by their bodies to breathe and obtain oxygen. Unintended weight loss is another concerning sign, often occurring in the later stages of the disease when the body's energy expenditure is high due to the effort required for breathing.

In some instances, COPD may cause edema, which leads to swelling in the ankles, feet, or legs. This happens because the heart has to exert effort to pump blood through the lungs when their function is compromised. Consequently, there is an accumulation of fluid, in the extremities. Furthermore, individuals suffering from COPD may experience episodes known as exacerbations. These episodes are characterized by a deterioration of symptoms that go beyond the day, to day fluctuations. Exacerbations can persist for days. Have adverse effects on both respiratory function and overall wellbeing.

COPD usually develops very slowly over many years and its clinical features may remain subtle. COPD is a condition that affects the body and can be linked to diseases outside of the lungs, including issues, weakened bones, depressive feelings, and diabetes. It's important to note that COPD is an illness meaning it worsens over time particularly if someone continues to smoke. Individuals with COPD can face a heightened risk of developing heart disease, lung cancer, and other health conditions.

Individuals who have received a diagnosis of COPD may also go through episodes known as exacerbations during which their symptoms worsen beyond the day, to day fluctuations and persist for days or even longer. These exacerbations can be triggered by factors like infections, environmental elements. Not following prescribed medications. It's important to note that exacerbations can sometimes result in the need for hospitalization. This might have an impact on quality of life, and even may increase mortality rates.

COPD severity is categorized based on the level of airflow restriction, which is assessed through spirometry measurements. There is a classification available for COPD in which it's classifies COPD into four stages taking into account the ratio between forced expiratory volume, in one second (FEV1) and forced capacity (FVC).<sup>19</sup> Those stages are: Stage I: Mild COPD.  $FEV1/FVC < 0.7$ ;  $FEV1 \geq 80\%$  predicted, stage II: Moderate COPD.  $FEV1/FVC < 0.7$ ;  $50\% \leq FEV1 < 80\%$

predicted, stage III: Severe COPD.  $FEV1/FVC < 0.7$ ;  $30\% \leq FEV1 < 50\%$  predicted, Stage IV: Very severe COPD.  $FEV1/FVC < 0.7$ ;  $FEV1 < 30\%$  predicted or  $FEV1 < 50\%$  predicted plus chronic respiratory failure.

The severity of symptoms and the frequency of exacerbations are also important factors to consider in the management of COPD.

### **Management**

COPD is a condition that is affected by factors, such as sociodemographic characteristics, physiological aspects, psychological elements, sociocultural influences, and environmental components. However, most of the research primarily takes a cross sectional approach concentrating on individual factors and lacking in depth discussions. This method can only make educated guesses about the connections between variables. Faces challenges in establishing causation. Patients with COPD often encounter symptoms such as a fear of experiencing shortness of breath, fatigue, feelings of anxiety and depression. These symptoms are closely linked to decreased levels of activity.<sup>20,21</sup> Notably, female COPD patients tend to exhibit lower energy expenditure in PA compared to males, warranting increased attention to their PA levels. Specific recommendations, such as walking and square dancing, have been proposed for middle-aged and elderly women, emphasizing group activities to boost exercise self-efficacy and PA levels.

### **Exercise rehabilitation**

Some studies looked at current interventions for people with COPD, including PR and different types of exercise training as well as self-management and education. Other studies have looked at special types of nutritional supplements, oxygen therapy, surgery, muscle stimulation, and singing.<sup>22</sup>

Some strategies that did work involved exercise training, physical activity counseling, and COPD medications. Some studies showed that people did an extra 6 to 24 minutes of at least moderate-intensity physical activity, as well as walking for longer or taking more steps each day.<sup>23</sup> However, we still have some doubts regarding the timing and implementation of these approaches. Only a limited number of studies conducted intervention follow-ups. The exact measures needed to enhance term activity, which is crucial, for reaping health benefits remain unclear.

Over time, individuals with COPD typically experience decreasing PA levels, which worsens the disease's progression. Physical inactivity stands out as the factor when it comes to predicting overall mortality among individuals with COPD. Beyond sociodemographic factors, disease characteristics, and behavioral changes significantly impact COPD outcomes. Timely symptom identification and active intervention are essential to slow

disease progression and reduce mortality rates. A substantial portion of COPD patients, roughly 53.5%, remain inactive, placing them at higher risk for anxiety and depressive symptoms. On the other hand, those engaging in full PA enjoy longer life expectancies, with additional years added to their lifespan. However, it is important to recognize that these inquiries have limitations. These limitations include sample sizes, imbalanced representation of sexes different lengths of follow-up periods, and the potential for recall bias due to the use of self-reported questionnaires.

Many exploration studies have been led to evaluate what exercise interventions can do for people determined to have COPD. These interventions encompass PR, pedometer monitoring, self-efficacy enhancement, and behavior change techniques, collectively aiming to enhance exercise capacity and improve the quality of life. PR alone may not significantly increase PA levels, but when combined with physical activity counseling and behavior change technology, it can effectively do so. Pedometers have proven effective in enhancing PA levels, although issues with patient compliance and long-term sustainability persist. Theory-based behavior change interventions, often integrated with PR, have been well-received by patients but demand substantial healthcare resources due to their time-consuming nature. At present, we still lack understanding of the timing, intensity, and frequency, of physical activity interventions in COPD patients. It's worth noting that a majority of patients do not meet the recommended guidelines for engaging in intense activity. Light-intensity activities, which are more readily accepted by patients, have shown promise in reducing all-cause and respiratory mortality.

In the management of COPD, exercise interventions play a pivotal role in which these interventions have the goal of improving the ability to function enhancing one's quality of life and slowing down the progression of diseases. Programs, for rehabilitation, which include supervised exercise training, educational sessions, and psychological support that cater to needs have consistently shown significant advantages in terms of improving endurance during physical activity reducing breathlessness, and overall well-being. Incorporating aerobic exercises like walking, cycling, and swimming into COPD management plans can improve cardiovascular fitness and alleviate symptoms.<sup>20</sup> These activities can be adapted to individual capacities, ensuring safety and gradual progress. Resistance training is integral to addressing skeletal muscle weakness in COPD patients. It helps to enhance muscle strength, endurance, and functional performance. It also reduces fatigue and improves daily activities. Focusing on respiratory muscles, inspiratory muscle training enhances breathing efficiency, reducing the effort required for breathing and improving overall respiratory function.

The progress, in telemedicine has enabled the creation of exercise programs that can be done at home making them

available to patients who are unable to go to rehabilitation centers.<sup>24</sup> Along with these exercise programs, it is crucial for symptom management. Preventing worsening of symptoms includes medication therapy that involves bronchodilators and anti-inflammatory agents. Proper nutrition is crucial for COPD patients as it supports muscle maintenance and recovery. Holistic management often includes dietary counseling and supplementation when necessary.

## CONCLUSION

Managing COPD requires strategies that consider various factors that influence the condition. COPD is an illness marked by symptoms such as difficulty breathing, wheezing, tightness in the chest, persistent cough with mucus, frequent respiratory infections, fatigue, unintentional weight loss, and occasional swelling, in certain cases. The severity of COPD is categorized based on airflow restriction, with four stages ranging from mild to very severe. Incorporating aerobic and resistance exercises into COPD management can further improve cardiovascular fitness, muscle strength, and daily functionality. Inspiratory muscle training focuses on enhancing breathing efficiency.

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