Saúde e Pesquisa
DOI: 10.17765/2176-9206.2024v17n1.e12549

Telerehabilitation as a strateg y to promote the health of patients with Chronic Obstructive Pulmonary Disease: a narrative review

Telerreabilitação como estratégia para promoção da saúde de pacientes com Doença Pulmonar Obstrutiva Crônica: revisão narrativa

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ABSTRACT
The prevalence of Chronic Obstructive Pulmonary Disease (COPD) is expected to increase in the coming decades. Many patients fail to undergo Pulmonary Rehabilitation (PR) due to multiple factors. This study aims to present a narrative review that offers a synthesis of the importance of telerehabilitation as a strategy to improve the health and well-being of patients with chronic obstructive pulmonary disease. To this end, studies that address this subject were selected, using mainly the MEDLINE, PubMed, Science Direct, SciELO databases. After the searches were carried out, the articles were screened considering the title and abstract and the studies that best described the subject covered were selected. The importance of multidisciplinary and innovative approaches to face the growing challenge of COPD is highlighted, with an emphasis on health promotion, prevention, diagnosis, management and telerehabilitation as key tools to improve quality of life and accessibility to treatment for patients with this condition.

Keywords: Chronic Obstructive Pulmonary Disease. Health Promotion. Telerehabilitation.

RESUMO
A prevalência da Doença Pulmonar Obstrutiva Crônica (DPOC) deverá aumentar nas próximas décadas. Muitos pacientes deixam de realizar a Reabilitação Pulmonar (RP), devido a múltiplos fatores. Este estudo tem como objetivo apresentar uma revisão narrativa que ofereça uma síntese da importância da telerreabilitação como estratégia para melhora da saúde e bem estar dos pacientes com doença pulmonar obstrutiva crônica. Para tanto, foram selecionados estudos que abordam esse assunto, utilizando-se principalmente as bases de dados *MEDLINE*, *PubMed*, *Science Direct*, *SciELO*. Realizadas as buscas, foi feita uma triagem dos artigos considerando o título e resumo e foram selecionados os estudos que melhor descreviam o assunto abordado. Evidencia-se a importância de abordagens multidisciplinares e inovadoras para enfrentar o desafio crescente da DPOC, com ênfase na promoção da saúde, prevenção, diagnóstico, gestão e telerreabilitação como ferramentas-chave para melhorar a qualidade de vida e a acessibilidade ao tratamento para pacientes com essa condição.

Palavra-chave: Doença Pulmonar Obstrutiva Crônica. Promoção da Saúde. Telerreabilitação.

1 INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a complex and progressive condition characterized by irreversible obstruction of airflow in the airways, with manifestations such as bronchitis and emphysema[1,2]. These abnormalities result from inflammatory and structural interactions throughout life, contributing to lung damage and changes in the process of lung development or aging. Besides smoking, environmental and genetic factors, such as exposure to air pollution and genetic mutations, play significant roles in the development and progression of COPD[3,4].

COPD is one of the leading causes of morbidity and mortality worldwide, with a growing prevalence, particularly among the elderly population[5,6]. The cost of treating COPD is directly linked to its severity, with hospitalization and ambulatory oxygen costs increasing as the condition worsens[2,7]. Deterioration of lung function in COPD contributes to exacerbated symptoms and acute events, such as exacerbations, which directly impact the patient's health status and prognosis[2].

Management of COPD requires a multidisciplinary and multimodal approach, with Pulmonary Rehabilitation (PR) emerging as an effective therapeutic strategy. PR, which includes supervised physical training and breathing exercises, has been shown to significantly improve dyspnea, quality of life and exercise tolerance in patients with COPD[2,8,9]. However, there are significant challenges to participating in PR programs, including barriers to access and adherence, highlighting the need for alternative approaches such as telerehabilitation[10].

Telerehabilitation, which offers rehabilitation services remotely through information and communication technologies, appears as a promising alternative to overcome the obstacles associated with performing PR conventionally[10,11]. The application of telerehabilitation with breathing exercises may represent an innovative and effective approach to improving the health and well-being of patients with COPD, reducing access barriers and increasing adherence to treatment programs[10].

Therefore, this study aims to perform a narrative review of the literature to summarize the importance of telerehabilitation and breathing exercises as strategies to improve the health and well-being of patients with Chronic Obstructive Pulmonary Disease, highlighting their potential contributions to public health policies and clinical practices.

2 METHODOLOGY

For the accomplishment of this study, which is a narrative review, searches for scientific studies were conducted in the databases MEDLINE, PubMed, Science Direct, Scientific Electronic Library Online (SciELO), and the Latin American and Caribbean Health Sciences Literature (LILACS). The article selection was carried out between June 1, 2023, and August 1, 2023. The temporal cut-off was from 2015 to 2023, understanding that this period would provide us with a significant number of articles.

Studies were included by crossing the following DeCs/MeSH terms: "Doença Pulmonar Obstrutiva Crônica" with the descriptors "telerreabilitação," "exercícios respiratórios," "promoção da saúde", "bem-estar," using the Boolean operator "AND" to associate them during the keyword cross-referencing, also opting for the translation of the descriptors into English: Chronic Obstructive Pulmonary Disease, Telerehabilitation, Health Promotion, Well-being.

No language restrictions were applied. Clinical trials, systematic reviews, meta-analyses, and case series were retained for inclusion consideration; case reports, editorials, dissertations, theses, and letters to the editors were automatically excluded from further

evaluation, as were studies that did not address the proposed topic or were duplicates..

After conducting the searches, articles were screened based on their title and abstract, and studies that best described the addressed topic were selected. Additionally, some other relevant publications were chosen from the references provided in these studies. The first author was responsible for the initial selection of articles to be included in this review; in case of doubts regarding the relevance of the selected articles, the final decision on inclusion was made by consensus among all authors. After the initial analysis, the selected articles were read in full to determine their inclusion in the research.

To ensure the assessment of the quality of this review, the design was conceived and conducted in accordance to the SANRA guidelines, which consist of a Scale for the Assessment of Narrative Review Articles[11].

3 RESULTS

Through literature review, a total of 29 articles from different academic databases (Chart 1) were considered suitable to meet the purposes of this narrative review.

Chart 1. Academic databases of the articles for the review.

Database	Number of articles
PubMed	20
Scielo	4
Medline	3
Science Direct	1
LILACS	1
Total	29

Source: Developed by the authors.

4 CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND PUBLIC HEALTH

Chronic Obstructive Pulmonary Disease (COPD) is one of the three leading causes of death worldwide, with 90% of these deaths occurring in low-income and middle-income[12]. The disease is characterized by persistent respiratory symptoms and irreversible airflow limitation. Typically progressive and associated with chronic inflammatory response in the airways and lungs, it has high prevalence and mortality rates. Globally, the prevalence of COPD is expected to increase in the coming decades due to continuous exposure to risk factors and population aging. Statistics show that by the year of 2030, COPD will be the third leading cause of death worldwide[13].

Estimates suggest that among developing countries, the disease exhibits widespread variability in prevalence, causes, clinical presentation, and mortality, and such differences are related to access to spirometry and scarce epidemiological data. Regarding epidemiology, COPD is a multifactorial disease and is associated with exposure to environmental pollution, unfavorable socioeconomic conditions, and genetic abnormalities. Although smoking remains a significant risk factor for COPD, in low- and middle-income countries, between one-third to one-fifth of cases occur in individuals who have never smoked, and a substantial proportion of these cases are likely related to biomass use for cooking and heating, especially in women[12]. COPD can cause functional loss in various ways and imposes a significant and growing burden, both in direct and indirect costs to society[6].

COPD represents a significant public health challenge: many individuals suffer from this disease for years and die prematurely due to it or its complications, especially in developing countries[14]. In Brazil, the prevalence of COPD is 17% among individuals aged 40 and above, with the highest prevalence region in the Midwest with 25%, followed by the Southeast region with

23%, and the Southern region with the lowest prevalence of 12%[15].

Morbidity related to the natural history of COPD, especially infectious exacerbations and hospitalizations, is considered relevant, particularly in more severe forms of this condition. Such factors contribute to increased absenteeism from work and early retirement, thus promoting an increase in the direct and indirect costs of the disease. In Brazil, the history of public health policies for smoking control and COPD prevention began about three decades ago and culminated in the reduction of smoking prevalence in the country. However, measures for COPD treatment, including the distribution of free inhaler medications provided by public health services, are more recent advancements[14].

The treatment of COPD is wide, involving various public policy strategies. Among them, measures for smoking cessation, such as nicotine replacement and pharmacotherapy, reliably increase long-term smoking abstinence rates. Strategies should also include incentives for better adherence to pharmacological therapy, as it can reduce COPD symptoms, exacerbation frequency and severity, as well as improve health status and exercise tolerance. Influenza vaccination is also a public policy strategy that reduces the incidence of lower respiratory tract infections and should be recommended. Finally, pulmonary rehabilitation, including physical and respiratory training, and specific education about the disease, improves exercise capacity, symptoms, and quality of life across all severity levels of COPD[2].

COPD represents a significant public health challenge, however the disease is preventable and treatable; therefore, measures to increase awareness, improve prevention, and management of COPD should be implemented across all healthcare spheres, and public policies should converge to achieve these goals. It is essential to emphasize the need of encouraging and fostering greater research interest in this highly prevalent disease.

4.1 HEALTH AND WELLNESS STRATEGIES FOR PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Therapeutic options for COPD include smoking cessation (the option with the greatest impact on the natural history of COPD), pharmacological therapy (mainly inhaled bronchodilators), and non-pharmacological treatment (PR). The GOLD (Global Initiative for Chronic Obstructive Lung Disease) strategy is defined as a global strategy for the diagnosis, management, and prevention of COPD. It occurs through a coordinated worldwide effort by leaders with an interest in promoting GOLD's objectives in their home country. Health education programs, management, and prevention of COPD are developed by individuals involved in all aspects of health and health policy. The report is based on current scientific evidence[2].

To address the heterogeneity and complexity of COPD in clinical practice, a strategy based on so-called "treatable traits" is used, which can be identified based on phenotypic recognition and/or understanding of critical causal pathways (endotypes) through validated biomarkers that identify patients at risk of exacerbation[2]. The treatable characteristics can coexist in the same patient and change over time (spontaneously or because of the treatment). Two main characteristics can be highlighted, such as persistent dyspnea and exacerbations, however, there are many more pulmonary and extrapulmonary characteristics, as well as behavioral/social risk factors, that demand individual assessment, attention, and treatment, if present[16].

PR is a comprehensive intervention based on thorough patient assessment followed by customized therapies that include, but are not limited to, physical training, education, self-management intervention, behavior changes, to promote long-term adherence to health-improving behaviors[17]. PR should be considered as part of integrated patient management and typically

involves a variety of healthcare professionals. Patients should undergo a thorough assessment before enrollment, including identification of the goals por the patient, specific healthcare needs, smoking history, nutritional health, self-management ability, health education, psychological health status, social circumstances, comorbid conditions, as well as exercise capacities and limitations[9].

The optimal benefits are achieved through programs lasting 6 to 8 weeks. Available evidence indicates that there are no additional benefits in extending PR to 12 weeks. Supervised physical training at least twice a week is recommended, which may include any regimen of resistance training, interval training, strength/resistance training; ideally, both upper and lower limbs should be included, as well as walking exercises; flexibility, inspiratory muscle training, and neuromuscular electrical stimulation may also be incorporated. In all cases, the rehabilitation intervention (content, scope, frequency, and intensity) should be individualized to maximize personal functional gains[18].

The intervention may include phone calls and progressively setting goals, and the importance of long-term behavior change to improve physical functionality and reduce the psychological impact of COPD should be emphasized to the patient. The benefits of PR for COPD patients are significant, and rehabilitation has been shown to be the most effective therapeutic strategy for improving dyspnea, health status, and exercise tolerance[2,18].

PR demonstrates benefits in health-related quality of life across all severities of COPD, although the evidence is particularly strong in patients with moderate to severe disease[19]. PR improves dyspnea, health status, and exercise tolerance in stable patients, reduces hospitalization among those who have had a recent exacerbation, and leads to a reduction in symptoms of anxiety and depression. Health and well-being benefits have also been demonstrated with education and self-management; communication with a healthcare professional improves health status, reduces hospitalizations, and visits to emergency rooms[20].

4.2 TELEREHABILITATION AND HEALTH PROMOTION FOR PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

There is evidence that the main components of PR are: physical training combined with specific education and self-management interventions[21]. However, there are numerous obstacles associated with the availability of PR services, such as difficulties in the public and private healthcare system, the lack of programs and facilities for PR, as well as challenges related to the availability of transportation to the sessions[20].

Telehealth interventions are those that provide health care remotely through the use of telecommunications or virtual technology. Telerehabilitation is a domain of telehealth, which uses information and communication technologies to provide clinical rehabilitation services remotely. Remote communication between the patient and healthcare professional may utilize telephone (including text messaging), internet or video conferencing technologies. Telerehabilitation has been proposed as an alternative to traditional approaches. Evidence shows that this alternative is safe and has similar benefits to conventional PR[10].

Telerehabilitation provides greater access to healthcare and brings options for patients who are geographically or socially isolated, individuals with transportation difficulties due to the severity of the disease or comorbidities, and serves as an option for regions with a scarcity of conventional PR[22,23]. In addition to the exercises proposed in telerehabilitation protocols, other components of PR can be included, such as health education for self-management of the disease. Telerehabilitation models have the potential to positively influence

the acceptance and accessibility of PR services for all patients with COPD[10].

After the COVID-19 pandemic, telerehabilitation became evident as an alternative for patients with indications for PR, being the most appropriate method due to the risk of transmission, as it allowed social distancing, and demonstrated to be as beneficial as conventional PR in patients with chronic respiratory diseases, such as COPD, interstitial lung disease and bronchiectasis[24]. It is suggested that telerehabilitation may be able to reduce costs in the treatment of patients with COPD, in addition to being a health promotion strategy for such patients.

In a global context, chronic respiratory diseases, such as COPD, are often associated with high healthcare costs, morbidity and mortality due to persistent symptoms, limitations in the daily activities, and exacerbations that require immediate support. Chronic respiratory diseases disproportionately affect developing countries where resources for research, prevention and management are scarce, culminating in a high rate of global morbidity and mortality caused by chronic respiratory diseases[12].

The impact on the socioeconomic, health, and well-being of chronic respiratory diseases is expected to increase in the coming decades. The United Nations (UN) has identified the prevention and control of non-communicable diseases as an urgent development issue essential to achieving the Sustainable Development Goals (SDGs), which aim to reduce the risk of premature mortality from non-communicable diseases by 2030[13]. Strategies must be focused on health promotion, prevention, diagnosis and management that allow achieving genuine universal health coverage.

The standard treatment for smoking-related COPD includes non-pharmacological interventions and pharmacological treatment. These interventions are underutilized in low- and middle-income countries. Data from Latin America reveals that only half of smokers received medical advice, a quarter received any respiratory medication, and access to influenza vaccination is inadequate. Therefore, there is an urgent need for better epidemiological data, accurate diagnosis and appropriate clinical care for COPD in low- and middle-income countries[12].

Approaches to health promotion include several strategies such as the use of approved standardized guidelines for diagnosis and treatment, enhanced access to exams as spirometry, increased availability of inhaled therapies, improved education for both patients and healthcare providers, and improved access to long-term follow-up, as well as programs designed to approach the multimorbidity often found in COPD. Broad access to non-pharmacological interventions, smoking cessation and PR must be prioritized and adapted to specific cultural contexts. Policy approaches in regulating the reduction of direct and passive exposure to smoking require sustained long-term support[12].

As a global strategy for health promotion of individuals with non-communicable diseases such as COPD, emphasis should be placed on the 2030 Agenda, established by the UN. This agenda outlines plans that ought to stimulate actions of countries in the search for sustainable development, and for that, 17 SDG were established with 169 targets. SDG 3 proposes to ensure a healthy life and promote well-being for everyone, at all ages. More specifically, target 3.4 envisages reducing premature mortality from non-communicable diseases by one third through prevention, treatment, promotion of mental health and well-being[13].

4.3 BREATHING EXERCISES AND PULMONARY TELEREHABILITATION FOR PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Respiratory muscle dysfunction is frequently observed in patients with COPD. The weakening of respiratory muscles and the

compensatory increase in respiratory muscle demand may further exacerbate respiratory muscle dysfunction in these patients. In individuals with COPD, in order to move the rib cage, the ventilatory demand increases the activity of the respiratory accessory muscles. In case of inspiratory muscle fatigue, there may be asynchrony between the rib cage and abdominal movement, with paradoxical abdominal retraction during inspiration. Therefore, respiratory retraining aims to alter the recruitment of respiratory muscles in order to reduce dyspnea and hyperinflation, and improve respiratory muscle performance and optimize thoraco-abdominal movement[25].

Implementing breathing exercises that improve respiratory muscle function and potentially reduce symptom severity in COPD patients is essential. Breathing exercise is defined as any breathing technique that can allow deeper inhalation or exhalation, or change the rate, pattern or rhythm of breathing[8].

Several respiratory retraining techniques have been used in COPD, including diaphragmatic breathing (also known as respiratory control or abdominal breathing), pursed-lip breathing, active exhalation, ventilatory stimulation, and ventilation feedback training. These techniques may result in acute improvements in gas exchange and ventilation, increased respiratory muscle function and exercise tolerance, reduced dyspnea, optimization of rib cage movement, reduced hyperinflation and improved quality of life for these patients[25,26].

Respiratory muscle training aims to improve both inspiratory muscle strength and endurance and has been used in people with respiratory diseases such as COPD and asthma, to improve respiratory muscle performance and improve exercise capacity. The impact of respiratory retraining in patients with COPD may vary according to the underlying pathophysiology, the technique to be used, and the training conditions[8].

Breathing exercise is an important part of the PR program for patients with COPD, including training in breathing exercises and exercises for the respiratory muscles. Compared with other treatment methods, breathing exercises are simple to operate, have no location restrictions, and do not require excessive capital investment, which can greatly improve the initiative and compliance of the patients[27]. Diaphragmatic breathing and pursed-lip breathing can be performed separately or combined, and play a fundamental role in the management of dyspnea in patients with COPD, in addition to being a strategy for those who are unable to perform physical training. In recent years, an increasing number of studies have evidenced that breathing exercises can significantly improve pulmonary function[28].

Diaphragmatic breathing consists of smooth breathing and deep nasal inspiration with anterior displacement of the abdominal region, which emphasizes the action of the diaphragm. For patients with COPD, the immediate benefits are increased tidal volume and oxygen saturation, reduced respiratory rate and improved ventilation and hematosis. Adverse effects include an increase in asynchrony and paradoxical movement of the rib cage, as well as increased work of breathing and dyspnea in individuals with more severe conditions[28].

Pursed-lip breathing consists of a gentle exhalation performed for 4 to 6 seconds, against the resistance of partially closed lips and teeth, and is a breathing pattern often adopted immediately and voluntarily by some individuals with COPD to control and alleviate dyspnea, and can be performed at rest or during exercise. The benefits of pursed-lip breathing in individuals with COPD include decreased respiratory rate and lung hyperinflation, improvements in partial pressure of carbon dioxide and oxygen in arterial blood, increased tidal volume and oxygen saturation[28], in addition to increasing confidence in patients in their ability to use the technique to treat dyspnea in the long term, especially its use at night[30].

The combination of these techniques (diaphragmatic and pursed-lip breathing) in individuals with COPD is more effective than performing the exercises separately, promoting a significant increase in tidal volume, as well as a reduction in respiratory rate compared to calm breathing[28].

Breathing exercises are a direct method of muscle training and are highly targeted and less restricted by the environment, and are an effective method of home PR that can be practiced independently by patients with COPD. Home breathing exercises are beneficial for pulmonary function, respiratory muscle strength, dyspnea and health-related quality of life in patients with COPD[29].

The characteristics of both exercises, their easiness of execution and the absence of constraints on the location and time of execution, allow their inclusion in a long-term PR. However, it is necessary to clarify that a combined program of breathing exercises and physical training can achieve greater benefits[29,30].

Evidence suggests that PR carried out through telerehabilitation for people with COPD can achieve beneficial results for participants, similar to those of traditional PR carried out in clinics, without identified safety problems[23]. However, more investigation should be carried out considering the clinical effect, duration of benefit, period of intervention and the economic cost of telerehabilitation. Telerehabilitation models may include (but are not limited to) speaking with a healthcare professional on the phone, through a website, app, or via video conferencing. In some circumstances, telerehabilitation may require patients to have access to their own device (e.g., phone, smartphone, tablet or computer) to participate[10].

These technological modalities have the ability to provide the essential components of PR, including monitoring physiological signs and symptoms during exercise remotely in real time. Additionally, they can provide supervision and feedback for physical training and discuss self-management education. Supervision of physical training during telerehabilitation may involve direct (e.g., real-time auditory or audiovisual communication) or indirect (e.g., via text message) feedback. Telerehabilitation models can also offer unsupervised physical training, whereby standard or automated warnings and feedback are provided to individuals via technological modalities. Telerehabilitation can be carried out directly in the patient's house or in a nearby health center[10,23].

Telerehabilitation may be a treatment alternative for individuals with COPD, however, it is also possible that a lack of conventional supervision and support from other participants may negatively affect rehabilitation outcomes. Improving the access to PR through alternative healthcare service models has the potential to improve health results, reduce total hospitalizations and the use of healthcare services for people with chronic respiratory diseases. Therefore, telerehabilitation has the potential to overcome known barriers to participation in conventional PR and may be an alternative to the treatment[10].

5 CONCLUSION

Telerehabilitation can be considered a promising alternative to overcome barriers to participation in PR, especially in scenarios where physical presence is limited, as it was during the COVID-19 pandemic. This type of intervention offers the possibility of providing quality healthcare to patients with COPD, even in geographically isolated areas, and promotes accessibility to rehabilitation services. However, there is a need for more robust investigations to assess the clinical impact, duration of benefits and economic cost of telerehabilitation, as well as the importance of supervision and support during the process.

This review highlights the importance of multidisciplinary and innovative approaches to addressing the growing challenge of COPD, with an emphasis on health promotion, prevention, diagnosis, management and telerehabilitation as tools to improve quality of life and accessibility to treatment for patients with this condition.

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Received: 03 mar. 2024
Accepted: 09 mar. 2024