

# Role of Telerehabilitation in Patients With COPD: A Brief Review

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## ABSTRACT

Chronic obstructive pulmonary disease is a reversible lung disease that is characterised by persistent respiratory symptoms and airflow limitation. The airflow limitation may be due to alveolar and airway abnormalities, usually caused by significant exposure to noxious particles. India is estimated to have 30 million COPD patients at present. Chronic and progressive dyspnoea is the most common symptom of COPD. Dyspnoea is the major cause of anxiety and disability in COPD. There are various exercises for pulmonary rehabilitation for patients with COPD. Telerehabilitation is an approach in which rehabilitation is provided at the patient's work place, home, or other place through video-conferencing, video-based, or Gmail. Various physical exercises, such as strength exercise, endurance exercise, and breathing exercise, can help in the management of dyspnoea, quality of life, and exercise capacity. Studies have supported that telerehabilitation could result in better control of dyspnoea, quality of life, and exercise capacity in patients with COPD. Studies conducted till date have not reached a definitive conclusion for forming a definitive protocol for telerehabilitation exercise in patients with COPD. Hence, in order to establish

a definitive telerehabilitation protocol for patients with COPD, further research needs to be conducted.

**Keywords:** Telerehabilitation, Videoconferencing, Video-based, COPD, Quality of Life, Dyspnoea, Exercise Capacity

## INTRODUCTION

Global initiative for Chronic Obstructive Lung Disease defines chronic obstructive pulmonary disease as a widespread condition that can be prevented and treated and is characterised by airflow restriction and persistent respiratory symptoms. This airflow limitation may be due to airway and alveolar abnormalities, usually caused by significant exposure to noxious particles or gases. COPD is caused by a mixture of small airway disease, parenchymal destruction (emphysema), whose relative contributions vary from person to person, and destruction of lung parenchyma. Airflow restriction and mucociliary dysfunction, two symptoms of the condition, may be exacerbated by the loss of tiny airways. COPD and other chronic respiratory disorders are becoming more

common in India and around the world. India is estimated to have 30 million COPD patients (< 20% of global COPD) at present, with an incidence of 64.7 deaths per 100,000 all-cause mortality. COPD is projected to be the 3rd largest noncommunicable disease-causing mortality in 2030 by the World Health Organisation. The comorbidities of COPD consist of all the physiological, mechanical, and psychological alterations and disorders associated with the disease.<sup>1</sup> Chronic and progressive dyspnoea is the most characteristic symptom of COPD. Dyspnoea is a major cause of disability and anxiety in COPD. The terms used to describe dyspnoea vary individually and culturally cough. Chronic cough is often the first symptom of COPD and is frequently discounted by the patient as a consequence of smoking or environmental exposures. The conventional definition of chronic bronchitis is regular sputum production for 3 months or more in two consecutive years. Large amounts of sputum may be produced by patients who also have bronchiectasis. Wheezing and chest tightness may vary between days and throughout a single day. Fatigue, weight loss, and anorexia are common in patients with more severe forms of COPD. Spirometry is required to make the diagnosis in this clinical context; a postbronchodilator FEV1/FVC less than 0.70 confirms the presence of persistent airflow limitation and identifies the presence of COPD in patients.<sup>2</sup> Spirometry is the most reproducible and objective measurement of airflow limitation. It is a noninvasive and readily available test. A post-bronchodilator fixed ratio of FEV1/FVC less than 0.70 is the spirometry criterion for airflow limitation. GOLD classification of chronic obstructive lung disease.<sup>2</sup>

FEV <sub>1</sub> (Percentage predicted)	
GOLD 1	>80
GOLD 2	50-79
GOLD 3	30-49
GOLD 4	>30

Prevention and Maintenance Therapy: Smoking cessation influences the natural history of COPD. Nicotine replacement therapy increases long term smoking abstinence rates and is more effective than placebo. E-cigarettes are becoming increasingly common as a method of nicotine replacement therapy. Varenicline, bupropion, and nortriptyline increase long-term quit rates but should be used as part of an interventional programme rather than as a sole intervention. Influenza vaccination reduces serious illness. Pneumococcal vaccines Pneumococcal conjugate vaccination (PCV13) and pneumococcal polysaccharide vaccine (PPSV23) are indicated for all individuals 65 and older. Bronchodilators increase FEV1 and reduce dynamic hyperinflation at rest and during exercise. Short-acting b2-agonist (SABA) and LABA agents relax airway smooth muscle. Ipratropium, a short-acting muscarinic antagonist, provides small benefits over SABAs in terms of lung function, health status, and the requirement for oral steroids. Exacerbations represent the main clinically relevant end point used for the efficacy assessment of anti-inflammatory drugs.<sup>2</sup> Pulmonary rehabilitation (PR) is a first management strategy in patients with COPD as it reduces breathlessness, increase exercise capacity and improve health related quality of life (HRQoL).<sup>3</sup> Telerehabilitation shall be defined as “telehealth application using telecommunication technologies to administer the rehabilitation services so that patient receives supervised rehabilitation at home, while the rehab specialist is at hospital.” Respiratory Telerehabilitation (RTR) is the reinforcement of exercise dosing, follow up, physical activity, nutritional and psychological counselling via telephone, social media such as Email, Twitter, and Facebook, activity monitors communicating with central hospital servers, and video conferencing to pulmonary disabled patients.<sup>1</sup>

**METHOD**

Studies were searched from the following engine PubMed, Google scholar and Research gate to review the literature. We included

experimental studies that investigated the dyspnoea, exercise capacity, and quality of life in patients with COPD.

Authors Journal Year	Objective	Design	Characteristics of the participants Sample size	Methods	Outcome Measure	Results	Limitations
Tousignant M, Marquis N et al 2012. <sup>4</sup>	To investigate the efficacy of in-home Telerehabilitation for people with COPD	Pre-experimental pilot study with pre-post-test and no control group.	Three participants were enrolled in this pilot study.	The first participant was a man (68 years old), the second was a woman (60 years old), and the third was a man (45 years old). Participants received 15 telerehabilitation sessions.	Locomotor function (6-MWD), quality of life (French version of CRQ), and Adherence were measured before and after intervention.	Except for the first participant, clinical results improved for all participants.	There are fewer participants.
Vasilopoulou M, Kaltsakas G et al 2016. <sup>5</sup>	To determine home-based maintenance telerehabilitation will be as effective as hospital-based maintenance rehabilitation and superior to usual care in reducing the risk of acute chronic obstructive pulmonary disease exacerbation, hospitalization, and emergency department visits.	Randomized control trial	147 participants of COPD were randomized.	A total of 147 COPD patients were randomly assigned to one of three groups. Group-A (telerehabilitation, 47), Group-B (hospital-based, 50), and Group-C (usual care) and intervention were delivered for 12 months.	Before and after intervention, spirometry, 6-MWT, incremental exercise test, daily physical activity (Actigraph GT3X, Actilife, Pensacola, FL), health related quality of life (SGRQ and CAT), and respiratory symptoms (mMRC) were measured.	Both the home-based maintenance telerehabilitation group and the hospital-based group had a lower rate of acute exacerbation of COPD and hospitalisations for acute exacerbation of COPD in the 12 months of follow-up than the usual care group, both the home-based telerehabilitation group and the hospital-based group were statistically improved in 6MWT than the usual care group, both the home-based telerehabilitation	Study design were not blinded, investigators were aware of the allocation of patients into the different maintenance rehabilitation group.

						group and the hospital-based group significantly effective improvement.	
Tsai LLY, McNamra RJ et al 2017. <sup>6</sup>	To determine the effect of supervised, home-based, real-time videoconferencing telerehabilitation on exercise capacity, self-efficacy, health related quality of life (HRQoL) and physical activity in patients with COPD compared with usual care without exercise training	Randomized control trial	A total of 37 patients were diagnosed with COPD.	Patients with COPD were randomly assigned to one of two groups: the supervised home-based telerehabilitation group (TG), which got exercise training three times per week for eight weeks, or the control group (CG), which received normal care without exercise training.	PFT, 6-minute walk test, incremental shuttle walk test (ISWT), endurance shuttle walk test (ESWT), Chronic Respiratory Disease questionnaire, and Sense Wear Armband (SWA) were all measured before and after intervention.	TG had a statistically significant improvement in endurance shuttle walk test time, an increase in self-efficacy, a statistically significant increase in Chronic Respiratory Disease Questionnaire score, and a significant difference in physical activity when compared to CG.	No. of participants are less
Bernochhi P, Vitacca M et al 2017. <sup>7</sup>	To evaluate the feasibility and effectiveness of an integrated home-based telerehabilitation programme (Telerehab-HBP).	Randomized, open, Controlled, multicentered trail.	112 participants were enrolled in this study.	Participants were divided into two groups, 56 per group, i.e., intervention group (IG) and control group (CG). Intervention was given for 4 months.	Before and after intervention, 6-MWD, time-to-time event, Medical Research Council (MRC), Physical Activity Profile (PASE), disability (Barthel), and QoL (MLHFQ and CAT) were measured.	IG showed significant improvement in 6-MWD compared to the CG group. MRC, PASE, Barthel, MLHFQ, and CAT showed significantly better improvement in the IG group than the CG group.	Due to the nature of the trial, it was not possible to blind the patient and healthcare workers to intervention.
Hansen H, Bieler T et al 2020. <sup>8</sup>	To determine if PTR is superior to conventional PR on the 6MWT and, secondarily, on respiratory symptoms,	Single blinded Randomized clinical trial	there were 134 participants (74 women and 60 men)	Participants were divided into two group. Pulmonary Telerehabilitation (PTR) 60 min, three times weekly for 10	Before and after intervention, the 6MWT, CAT Hospital Anxiety and Depression Scale (HADS),	There was no statistically significant between-group difference in 6MWD change following intervention. Both	Variation in exercise content and volume among the seven hospitals providing conventional PR that could not be

	quality of life physical activity, and lower limb muscle function in COPD patients.			weeks and conventional group, 90 min for two times weekly	EuroQol 5-Dimension Questionnaire (EQ-5D), 30s sit to stand test (30sec-STS), Clinical COPD Questionnaire (CCQ), and Physical Activity Level (PAL) were measured.	groups improved statistically significantly in 6MWD following intervention, however the gain was only sustained and significant in the PTR group at 22 weeks after baseline. There was a statistically significant difference in CAT score in the PTR group, and the PTR group had a statistically significant drop in HADS compared to the conventional group. For QoL (EQ-5D-VAS) and lower limb muscle function (30sec-STS), no group exceeded the MCID.	monitored or aligned.
Galdiz JB, Gomez A et al 2021. <sup>3</sup>	To determine whether a maintenance pulmonary telerehabilitation program, after intensive initial PR, is superior to usual care is sustaining over time benefits achieved by intensive PR	Randomized clinical trial	A total of 94 patients were diagnosed with COPD.	The patients were divided into two groups. The intervention group (IG) sent performance data to a web-based platform via an app and were enrolled in three weekly training sessions, while the control group (CG) was instructed to exercise regularly (usual care).	6-MWT, chronic respiratory disease questionnaire, SF-36 and compliance were measured before and after intervention	There was no significant improvement in 6-MWT in either group, however CRQ-emotion showed improvement in the IG group, and secondary linear mixed models showed improvement in the IG group in SF-36.	Lack of assessment of compliance with exercise recommendations in the control group

<p>Ghadimi S, Fakharian A et al 2021S, Fakharian A et al 2021.<sup>9</sup></p>	<p>Effects of telerehabilitation on quality of life, exercise capacity, and spirometry parameters in COPD patients</p>	<p>Randomized experimental study</p>	<p>N= 75 COPD diagnosed patients</p>	<p>Participants were randomized into telerehabilitation group (given a rehabilitation brochure and instructed to do the exercise three times a week for four weeks) and control group Isometric, aerobic, and respiratory exercise are included in pulmonary rehabilitation for 8 weeks, three times a week.)</p>	<p>Measurements were taken prior to and following the intervention for the 6-minute walk test, COPD Assessment test (CAT), modified Medical Research (mMRC), and spirometry.</p>	<p>Following rehabilitation, there were improvements in both groups. When compared to the other group, the telerehabilitation group's improvement was noticeably higher.</p>	
<p>Zanaboni P, Dinesen B et al 2022.<sup>10</sup></p>	<p>To compare long-term telerehabilitation or unsupervised treadmill exercise at home with standard care.</p>	<p>International randomized control trial</p>	<p>There were total of 120 participants.</p>	<p>Participants with COPD were randomly assigned into three groups, i.e., the telerehabilitation group, the unsupervised group, and the control group, for 30 minutes, 3-5 times per week for continuous training, and 3 times per week for interval training, for a two-year trial.</p>	<p>Before and after intervention, hospitalization and emergency, time free from the first occurrence, exercise capacity, dyspnoea, health status, quality of life, anxiety, depression, and subjective impression of change were all measured.</p>	<p>The telerehabilitation and unsupervised groups had lower rates of hospitalization and emergency department visits than the control group. For one year, the telerehabilitation and unsupervised training groups had superior health. Participants in the intervention achieved and maintained clinically significant gains in exercise capacity.</p>	<p>The study design made it impossible to compare the advantages of the intervention with standard center-based PR or maintenance programmers', and it was also unable to evaluate intervention fidelity across the group.</p>

## CONCLUSION

Physical activities including muscle strength training, endurance exercise, breathing exercise and relaxation exercise can help in improving symptoms of COPD. Telerehabilitation is a good way for the pulmonary rehabilitation in patients with COPD. There are many studies have been done on telerehabilitation. Most of the study showed significant improvement in telerehabilitation group than hospital-based or usual care group. Due to multiple limitation in studies conducted till date, no definitive protocol of telerehabilitation exercises in patient with COPD could be framed. In order to develop a definitive telerehabilitation protocol in patients with COPD and form an evidence-based exercise prescription for COPD patients so further researches needs to be conducted.

### Declaration by Authors

**Conflict of Interest:** The authors declare no conflict of interest.

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