

Telemedicine exercise as a potential therapy for improving mental health symptoms in COPD patients during COVID-19 pandemic: A literature review

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Abstract

Introduction: The COVID-19 pandemic significantly threatens chronic obstructive pulmonary disease (COPD) patients. They are likely to have depression and anxiety, which can increase morbidity and mortality. Telemedicine exercise has been proven to improve mental health symptoms in COPD patients.

Aim: To summarize the effectiveness of telemedicine exercise in improving mental health symptoms in COPD patients.

Method: Studies reviewed were obtained from PubMed and ScienceDirect. Randomized clinical trials showing telemedicine's effectiveness in improving mental health symptoms in COPD patients were searched last on 7 September 2023.

Result: Telemedicine for the health sector has various forms, such as online consultation, telemonitoring, and chatbots. Telemedicine exercise shows an improvement in symptoms of depression and anxiety based on the HADS scores for COPD patients suffering from mental health problems.

Conclusion: All studies reviewed conclude telemedicine exercise is a potential therapy for improving mental health symptoms in COPD patients during the COVID-19 pandemic.

Keywords: Telemedicine; Exercise; COPD; Mental Health; Depression; Anxiety; Therapy; Symptoms

1. Introduction

The ongoing COVID-19 pandemic poses a significant threat to an estimated 300 million people worldwide with chronic obstructive pulmonary disease (COPD), as they are more likely to contract the infection, develop severe symptoms, and die from the disease [1]. Importantly, depression and anxiety are common in people with COPD, affecting an estimated 40% and 36% of people, respectively [2]. Untreated depression and anxiety in COPD patient can increase the morbidity and mortality [3]. Recent study have shown that exercise can be an effective treatment for mental health disorders, such as depression and anxiety [4]. However, conventional therapy faces challenges in its efficacy, particularly in the case of COPD patients with mental health disorders, where it can be difficult to provide individualised training because of difficulty to meet with their personal trainer during pandemic COVID-19 [5]. As a solution, the application of

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telemedicine to the health sector was carried out [6]. The goal of this review is to provide a brief summary of the current findings on effectiveness of telemedicine exercise in improving mental health symptoms in COPD patients.

2. Materials and Methods

A literature exploration was performed using PubMed and ScienceDirect. The subsequent keywords were used: 'telemedicine exercise', 'COPD patient', 'mental health', 'depression', 'anxiety'. Randomized clinical trials showing telemedicine's effectivity in improving mental health symptoms in COPD patients were searched last on 7th September 2023. To maximize the findings, tracing was also carried out from the grey articles.

3. Result and Discussion

3.1. COPD

COPD, or chronic obstructive pulmonary disease, is a progressive lung disease that is caused by airflow limitation and causes persistent respiratory symptoms and long-term disability [7,8]. In COPD, the airways and air sacs lose their elasticity, the walls between the air sacs are destroyed, the walls of the airways become thick and inflamed, and the airways make more mucus than usual. All of these changes can make it difficult for air to flow in and out of the lungs [7]. The clinical manifestations of this disease are chronic and progressive dyspnea, chronic cough, excess sputum production, wheezing, chest tightness or fatigue [8]. These symptoms can lead to social isolation and contribute to the development of mental health problems, such as depression and anxiety [9]. COPD is not curable, yet, a healthy living and comprehensive medical care can significantly improve a patient's quality of life and slowing the disease's progression.

3.2. Mental Health

3.2.1. Depression

Depression (major depressive disorder or clinical depression) is defined as a prolonged feeling of sadness with moderate or severe intensity that results in a decrease in an individual's quality of life, even the desire to commit suicide [10–12]. Depression is the leading cause of disability worldwide and has a significant impact on a variety of disorders [13]. Depression affects approximately 280 million individuals worldwide, accounting for 3.8% of the afflicted population, including 5.0% of adults and 5.7% of persons over the age of 60 [11]. A cross-sectional study with a sample size of 17,734 respondents in Indonesia found that 23.47% of respondents showed symptoms of depression [13]. The development of depressive symptoms can be caused by several factors, such as a decrease in the expression of brain derived neurotrophic factor (BDNF) [14] which can interfere with the function of monoamine neurotransmitters (NE, 5-HT, DA) [15–17], γ -aminobutyric acid (GABA) neurotransmission dysfunction or impaired GABAergic signaling to the CNS and brain prefrontal cortex (PFC) [18], genetic factors (such as the GNB3, SLC6A3, SLC6A4 genes which are targets for depression therapy) [15], and chronic psychosocial stress factors which can increase the release of inflammatory mediators (IL-6, IL-2, TNF- α , and IFN- γ) and decrease the release of anti-inflammatory mediators (IL-4 and IL-10) [19]. This condition can result in changes in the brain's neural circuits, such as neurogenesis, deregulation of the hypothalamic–pituitary–adrenal (HPA) axis, which can disrupt the function of the frontal cortex and serotonergic transmission, resulting in the manifestation of depressive symptoms [19,20].

3.2.2. Anxiety

Anxiety disorders are the most prevalent type of mental health condition [21]. According to a systematic review research [22], the global prevalence of anxiety disorders is estimated to be 7.3%, which means that one in every fourteen people worldwide has anxiety at some point. Women are twice as likely as men to acquire anxiety; people over 55 have a 20% lower probability of experiencing anxiety than people between the ages of 35 and 54. Individuals with anxiety symptoms, in general, will experience excessive dread and worry, or will avoid hazards perceived in the environment (for example, social settings or unfamiliar places) or from internal sources (for example, strange body sensations) [21]. Anxiety is caused by many factors, including intricate connections between biological elements, the environment, and an individual's psychological state [23]. There are three main mechanisms related to the development of anxiety disorders, such as increased inflammatory reactions, decreased monoamine synthesis, increased glutamate, and changes in neural circuits. Several studies have found that innate immune activation mechanisms and the release of inflammatory cytokines in various areas of the brain (amygdala, insula, ACC) are linked to the onset of anxiety symptoms [24].

3.3. Mechanism of potential association between mental health and COPD

Psychiatric conditions, such as depression and anxiety, are frequently reported in people with COPD [25]. The link between depression and COPD is not clear, yet, studies suggest that CRP levels [26], chronic systemic inflammation (sTNFR-1 biomarker), smoking, and low arterial oxygen saturation that associated with periventricular white matter lesions play a role in modulating depression symptoms in COPD patients [27]. COPD patients with hypercarbia are more likely to experience anxiety attacks during dyspneic spells [26]. A number of factors related to the patient, such as their gender, age, smoking habits, level of airway obstruction, socioeconomic status, history of rehospitalization, and other medical conditions, have been associated with an increased prevalence and risk of depression and anxiety in people with COPD [3]. In addition, family history of depression, low self-esteem, traumatic experiences (such as sexual abuse in childhood) can increase the risk of anxiety and depression [26]. The interplay between COPD and mental health conditions can create a vicious cycle that can have a significant negative impact on a patient's health and well-being [27].

3.4. Current Treatments for COPD Patients with Mental Health Disorder

Antidepressants can produce varying outcomes when used in individuals with depression compared to those without COPD who are also experiencing depression due to the limited availability of studies specifically examining the effectiveness of antidepressants in COPD patients, the prevalence of executive dysfunction among COPD patients, which is linked to a reduced positive response to antidepressant treatments, and the elevated likelihood of antidepressant use among frail individuals, despite a lack of compelling evidence regarding their effectiveness in this context [9].

Table 1 Pharmacology treatment for mental health disorder

Studies	Treatment	Mechanisms	Limitations
[29,30]	TCAs Amitriptyline Nortriptyline Doxepin	Serotonin and noradrenaline reuptake inhibition.	Anticholinergic side effects, sedation, cardiac side effects, tendency to suicide.
[31,32]	MAOIs Phenelzine Selegiline	Preventing monoamine neurotransmitter breakdown and prolonging their availability.	Hypotension, weight gain, sexual dysfunction.
[33,34]	SSRIs Citalopram Fluoxetine Paroxetine Sertraline	Selective serotonin reuptake inhibitors.	Serotonin syndrome, allergic reactions, suicidal thoughts, withdrawal syndrome.
[35]	SNRIs Venlafaxine Duloxetine	Selectively reducing serotonin and noradrenalin reuptake.	Elevations in blood pressure, excessive sweating, rapid heart rate, trembling, heightened anxiety.
[5,28]	Exercise Endurance Aerobic Mindful exercise	Biochemical mechanisms involving factors.	Difficulty to meet with their personal trainer.

TCAs: Tricyclic antidepressants, MAOIs: Monoamine oxidase inhibitors, SSRIs: Selective serotonin reuptake inhibitors, SNRIs: Serotonin and norepinephrine reuptake inhibitors

A study by Mikkelsen et al. shows an increasing body of research acknowledges the beneficial impact of exercise on mood conditions like anxiety, stress, and depression through physiological and biochemical mechanisms involving factors such as endorphins, mitochondria, the mammalian target of rapamycin, neurotransmitters, and the hypothalamic-pituitary-adrenal axis [28]. However, conventional therapy faces challenges in its efficacy, particularly in the case of COPD patients with mental health disorders, where it can be difficult to provide individualised training

because of difficulty to meet with their personal trainer [5]. Table 1 summarises the mechanisms and limitations of each drug class of antidepressant.

3.5. Physical Exercise

Physical exercise has been shown to be efficient as a non-pharmacological therapy for several chronic diseases, one of which is mental health disorders [36]. Physical exercise is defined as physical activity that is planned, structured, repetitive, and aims to develop one or more components of physical fitness [37]. According to the American College of Sports Medicine (ACSM), a prescribed physical exercise program should involve the health components of cardiorespiratory (aerobic) fitness (CRF), muscle strength and endurance, flexibility, body composition, and neuromotor fitness. The time of physical exercise advised by ACSM to have an appropriate effect on health is around 40-90 minutes for each physical training session. ACSM advises a more detailed aerobic physical exercise regimen using the FITT-VP formula, which stands for frequency, intensity, time, type, volume, pattern, and progression [38].

3.6. Applicability telemedicine, challenge, current evidence

3.6.1. Applicability

The rapid spread of COVID-19 is a major challenge for the entire planet. One of the most important strategies for reducing the epidemic rate is social distancing, which can limit movement and productivity. As a solution, the application of telemedicine to the health sector was carried out. In this application, telemedicine has various forms, such as online consultation, telemonitoring, chatbots. Mobile application programs have been used to prevent and manage risk factors for various diseases, increase physical activity, provide feedback, and provide health information. Applications are used to monitor individual health status or changes in behavior (75.0%; 9 of 12), provide feedback about a person's health status (75.0%; 9 of 12), or provide health-related information (66.7%; 8 of 12). Most of the mobile applications have been developed and used by the study team based on the study objectives, but some use previously developed application programs [6].

Table 2 The effect of telemedicine exercise intervention on improving mental health

Studies	Sample	Intervention	Outcome
Hansen, 2020 [39]	PTR group (n=67) CPR group (n=67)	PTR: A group-based, supervised and standardized program conducted by patients in their homes via videoconference. Duration 60 minutes; 3 times per week for 10 weeks. CPR: A group-based, supervised and standardized program (in hospital). Training sessions combine warm-up, resistance and endurance exercises as well as a cool-down period. Duration 90 minutes; 2 times per week for 10 weeks.	The PTR group had a statistically significant reduction in anxiety and depression scores (HADS-A and HADS-D) compared with the CPR group after the intervention.
Bourne, 2017 [40]	Intervention group (Online PR, n=64) Control group (Face-to-face PR, n=26)	Through the myPR app, each week the duration of each of the 10 exercises is increased by 30 seconds, starting from 60 seconds in week 1, to 3½ minutes in week 6. The on-screen exercises are designed to be done with the patient in real time, with the patient following the video-facilitated exercises with one minute rest time for each exercise.	There was a significant improvement in symptoms of anxiety and depression in the intervention group based on the HADS scores.
Hansen, 2017 [41]	Total n=134 Intervention group (CORE, n=67)	The CORE group received group supervision of strength and endurance training, as well as online home education. Duration 60 minutes; 3 times per week for 10 weeks (in home).	There was improvement in symptoms of depression and anxiety based on the HADS scores.

	Control group (CCRe, n=67)	The CCRe group received group-based supervised resistance and resilience training as well as education. Duration 90 minutes, 2 times per week for 10 weeks (two group) or 12 weeks (six group) in hospital. The intensity of exercise was non-specific in both groups.	
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PTR: Pulmonary telerehabilitation group, CPR: Conventional pulmonary rehabilitation group, HADS-A: Hospital anxiety and depression scale-anxiety subscale, HADS-D: Hospital anxiety and depression scale-depression subscale, PR: Pulmonary rehabilitation, CORE: Online COPD rehabilitation program, CCRe: Conventional outpatient COPD rehabilitation

3.6.2. Challenge

The use of telemedicine exercise as an effective therapy for improving mental health symptoms in COPD patients is challenged by several factors. First, the technology must be reliable, user friendly, and a good internet connection is needed to ensure that the video and audio are clear. Second, some patients may not be comfortable with using technology. Third, clinicians may not be familiar with using telemedicine technology, or they may not have the time to provide the same level of supervision as they would in an in-person setting. Fourth, it can be difficult to monitor the patient's safety during a telemedicine exercise session, as the clinician may not be able to see if the patient is having any problems, and the patient may not be able to communicate their problems effectively. Fifth, telemedicine exercise can be more expensive than traditional exercise programs, as the cost of the technology and the clinician's time must be factored in.

3.6.3. Future Direction

Despite the challenges, telemedicine exercise has the potential to be a helpful tool for enhancing physical fitness and health outcomes. However, more research is required to determine the most effective way to use telemedicine exercise and to address its limitations. Several ways to improve the effectiveness of telemedicine exercise can be explored in future research, such as using reliable and user-friendly technology, providing training for patients and clinicians, using a combination of telemedicine and in-person visits, and developing standardized protocols.

3.6.4. Current Evidence

All studies by Hansen et al., Bourne et al., and Hansen et al. show that patients with telemedicine interventions with various frequencies and populations significantly reduce the Hospital Anxiety and Depression Scale (HADS) [39,40,41].

4. Conclusion

In conclusion, telemedicine exercise is a potential therapy in improving mental health symptoms in COPD patients during pandemic COVID-19. However, more research is required to determine the most effective way to use telemedicine exercise and to address its limitations.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest to be disclosed.

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