Critical Comments in Biomedicine
https://ccbjournal.ssu.ac.ir
eISSN: 2717-0403

Systematic Review

DOI: https://doi.org/10.18502/ccb.v2i2.7395

Comparison of Telehomecare Interventions in Controlling Chronic Obstructive Pulmonary Disease (COPD): Protocol for a Systematic Review and Meta-analysis

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Received: 2 February 2021 **Accepted:** 18 September 2021
Published 2021 Volume 2, Issue 2,

Abstract

Background: Chronic obstructive pulmonary disease (COPD) is considered the fourth main cause of mortality worldwide, affecting 10% of adults aged up to 40 years. Due to the growing elderly population and smoking, the global burden of COPD is expected to increase in the general population. Telemedicine may help patients with COPD to decrease exacerbation episodes and the associated costs. Moreover, Telehomecare (THC) may be considered as an alternative to cut down hospitalization costs and increase the patients' comfort.

Objectives: This study explains the methodology of a systematic review and meta-analysis designed to evaluate the impact of THC interventions on the control and management of COPD and its complications.

Methods: To review all published studies comparing THC interventions in controlling COPD and its complications, all studies published in PubMed, Google Scholar, Scopus, ISI Web of Science, Cochrane databases, HTA EED, DARE, Embase, SID, Magiran will be searched until the end of 2021. Randomized controlled trials (RCTs), cluster RCTs, controlled clinical trials comparing telehealth with standard monitoring of COPD patients were included. Independent reviewers will review the abstracts and full-texts of all relevant studies for eligibility, risk of bias, and data extraction using structured forms. The meta-analysis will be performed for adequately homogenous studies regarding their populations, interventions, and objectives.

Conclusion: The results of this systematic review and meta-analysis will provide useful information on the impacts of THC on COPD control. The evidence provided by this systematic review can be helpful for clinical specialists, public health policymakers, and the general population.

Keywords: Telemedicine, Chronic Obstructive Pulmonary Disease, Meta-Analysis, Systematic Review

How to Cite: Shoyukhi Z, Dehghani Mahmoodabadi A, Dehghan HR. Comparison of Telehomecare Interventions in Controlling Chronic Obstructive Pulmonary Disease (COPD): Protocol for a Systematic Review and Meta-analysis. Critical Comments in Biomedicine. 2021; 2(2): e1007.

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Introduction

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) defines chronic obstructive pulmonary disease (COPD) as a common disease characterized by the persistent airflow limitation of the lungs, which can be prevented and treated. Moreover, COPD is a naturally progressive condition in which chronic inflammatory responses to noxious gases are enhanced in both the airways and the lungs *[1]*. Respiratory exacerbation may occur due to the airflow limitation. COPD exacerbation is defined as an acute deterioration of the respiratory symptoms *[2]* adversely affecting patients' health status, often leading to hospital admission. In this regard,

Published online: September 2021

telehealthcare (THC) can reduce disease complications, hospitalization costs, and the need for contact with health services, especially in middle-income to low-income countries *[3]*. Telemedicine is a widespread concept, including the health information exchange and transmission using electronic devices. It can provide health services using information and communication technology (ICT) between patients and the health care experts, which is helpful in health monitoring and management *[4]*. This respiratory disease is a major consumer of health care resources, mostly due to its exacerbation. In COPD patients, telemedicine may help to decrease the exacerbation episodes and their costs. Moreover, providing healthcare at home may be considered as an alternative to cut down hospitalization costs and increase the patients' comfort *[5, 6]*.

One of the remarkable aspects of THC is telemonitoring, which plays a very important role in managing COPD patients. Telemonitoring is defined as using ICT for information exchange between patients and health experts. In telemonitoring, healthcare providers usually become informed of the patient's health status using a communication system installed in the patient's home through the regular entry of the required information. The entered information is transferred to a central system of data management in a real-time manner, which is designed to systematically monitor the patient's health status according to personal care protocols *[7-9]*.

Using pre-programmed intelligent functions, the device will alarm if the patient's condition exceeds certain limitations and provide decision support to the patient or the health care team. The health care team can monitor the patient's data remotely and respond quickly if necessary. Telemonitoring encourages the patients to manage their disease through providing regular patient monitoring by professional resource efficiency investment and remote interventions. Patient empowerment for effective self-monitoring prevents disease exacerbation, injury, and hospital admission if supplemented by consistent telemonitoring *[10, 11]*.

To the best of the authors' knowledge, no systematic review has been conducted in this field; therefore, this study aimed to provide a comprehensive review of THC in patients with COPD and its impact on disease management.

Method

This protocol is reported based on the Preferred Reporting Items for Systematic review and Meta-analysis Protocols PRISMA-P checklist 2015.

General and specific objectives

The main purpose of this study is to summarize the evidence related to the comparison of THC interventions in controlling COPD and its complications. The specific objectives include determining the effect of THC interventions on the results of COPD Assessment Test (CAT), Forced Expiratory Volume 1 (FEV1) index results, depression, mortality, the health-related quality of life, the quality of life specific to the disease under study, the number of hospital stays due to COPD.

Study eligibility

Participants

Patients who received THC interventions for COPD management or formed the control arm in THC studies.

Intervention

Telehomecare including telemonitoring, telerehabilitation, telemanagement, tele-education, and teleconsultation (televisit)

Comparisons

Usual care

Outcomes

Improvement in CAT, improvement in lung test results, depression prevention, mortality reduction,

reduction of direct and indirect disease cost, reduction of patient visits and hospitalizations, and quality of life improvement.

Type of studies

Randomized controlled trials (RCTs), clustered RCTs, controlled clinical trials (CCTs) or non-randomized clustered trials, and interrupted time-series studies.

Search strategy

Electronic databases

To review all published studies comparing THC interventions in COPD and its complications, PubMed, Google Scholar, Scopus, Web of Science, CRD Cochrane databases, HTA EED, DARE, Embase, SID will be searched until the end of 2021 (Table 1).

Table 1. The search strategy designed to find related publications in PubMed

Queries in PubMed	
Search	**Query**
#1	"Chronic Obstructive Lung Disease" OR "Chronic Obstructive Pulmonary Diseases" OR "COAD" OR "COPD" OR "Chronic Obstructive Airway Disease" OR "Chronic Obstructive Pulmonary Disease" OR "Airflow Obstruction, Chronic" OR "Airflow Obstructions, Chronic" OR "Chronic Airflow Obstructions" OR "Chronic Airflow Obstruction" OR " Pulmonary Disease, Chronic Obstructive "[MeSH Terms]
#2	(telemedicine [MeSH] OR telemedicine OR telehealth OR telecare OR telehomecare OR "tele-home care" OR "tele-homecare")
#3	#1 AND #2
#4	((telemedicine [MeSH] OR telemedicine OR telehealth OR telecare OR telehomecare OR "tele-home care" OR "tele-homecare") AND (("RCT") OR (trial*))
#5	#3 AND #4

Manual search

The reference lists of the selected studies and systematic reviews will be reviewed in the full-text reading phase to find additional studies. In this step, the full texts of the relevant articles will be reviewed to exclude irrelevant articles. The details of the reasons for exclusion will be recorded. PRISMA flow diagram for studies will be documented. Finally, the automatic part of EndNote software will be used to find duplicate studies and delete them.

Data collection and analysis

Selection of studies

Titles and abstracts of the studies will be independently reviewed by two authors.

Data extraction and management

Microsoft Excel will be used to prepare a data extraction form. The following information about each included article was independently extracted by two authors: the name of the first author, publication year, location of study, sample size and gender (male/female), mean age, study design, intervention duration, intervention type, and findings.

Exclusion criteria

The following studies will be excluded:

1. Studies published in languages other than English and Persian
2. Studies with no interventions, including systematic review protocols, systematic reviews, experimental and pre-experimental studies, etc.
3. Studies not reporting the number of participants in control and treatment groups
4. Studies lacking information required for analysis

Dealing with missing data

In case of missing data, the corresponding author will send an email three times, one week apart, to request the relevant data. In case of no response after three times, the study will be excluded.

Quality assessment

Given the study will be performed on clinical trial articles, the JADAD checklist will be used to evaluate

the quality of the reviewed studies. In evaluating the quality of the articles based on the Newcomer criteria, the articles received a score ranging from 0 to 7 points, with a higher score indicating higher quality *[12,13]*.

Data analysis

After data extraction, a meta-analysis will be performed if possible. The STATA software version 16 [StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC, USA] will be used to analyze and aggregate the results of the selected studies, and forest plots will be generated.

The mean changes in the quantitative results [such as respiratory or lung test results, CAT test results, and complication mean difference (MD)] in the control and intervention groups will be extracted to determine the differences as the effect size for meta-analysis. A random-effects model considering the diversity between studies will be used to perform the meta-analyses.

Assessment of heterogeneity

I-squared (I^2) statistic and Chi-square tests will be used to investigate the heterogeneity between studies. The value of I^2 ranges from 0 to 100. An I^2 value of 0-25, 25-50, 50-75, and 75-100 indicates no heterogeneity, weak heterogeneity, relatively high heterogeneity, and high heterogeneity, respectively. As for the Chi-square test, a P-value of less than 0.1 will be considered as significant heterogeneity. In case of high heterogeneity among studies, subgroup analysis or meta-regression will be used to find the source(s) of heterogeneity.

Subgroup analysis

Subgroup analysis based on the following variables will be performed to investigate the possible source of heterogeneity:

- Type of intervention
- Follow-up period (<4, 4-8, 9-12 and >12 months)
- Publication year

Sensitivity analysis

Sensitivity analysis will be used to evaluate the strength of the overall results.

Meta-bias: It will be evaluated whether the RCT protocol was published before study enrollment to determine the reporting bias and selective outcome reporting (outcome reporting bias). To evaluate the possible bias resulting from a small sample size (i.e., the usefulness of the intervention in smaller studies), the fixed effect estimate will be compared with the random-effects model. P values of less than or equal to 0.05 were considered significant.

Publication bias

Any potential publication bias will be assessed using a funnel plot diagram in addition to Begg's modified stratified correlation test and Egger's asymmetry regression test.

Discussion

This study will be conducted to compare THC interventions in controlling and managing COPD and its complications. This study will contribute to future studies by identifying the target populations who accept THC and the identification of feasible interventions. Finally, the current systematic review will help modify technological interventions to meet COPD patients' needs more effectively. This systematic review and meta-analysis will provide useful information on the impacts of THC on COPD control. The evidence provided by the results of systematic reviews can be helpful for clinical specialists, public health policymakers, and the general population.

Acknowledgment

The authors wish to thank Shahid Sadoughi University of Medical Sciences and Health Services for funding this study.

Authors' Contribution

HRD is the leading author and guarantor. ZSH and AD planned the study and led the drafting and revising of the manuscript. HRD, ZSH, and AD

contributed to drafting and revising the manuscript. All authors approved the submitted version of the manuscript.

Funding Source

This project was funded by Shahid Sadoughi University of Medical Sciences (1398/10/9-7022). The funders had no role in designing of the study, data collection, data analysis, data interpretation, or manuscript drafting.

Conflict of Interest

The authors declare that there is no conflict of interest.

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