Pulmonol. 2018;xxx(xx):xxx–xxx

PULMONOLOGY

www.journalpulmonology.org

ORIGINAL ARTICLE

Benefits and costs of home pedometer assisted physical activity in patients with COPD. A preliminary randomized controlled trial

K. Widyastuti[a,*], D.N. Makhabah[a], A.Rima Setijadi[a], Y.S. Sutanto[a], Suradi[a], N. Ambrosino[b]

[a] *Pulmonology Department, Medical Faculty, Sebelas Maret University/Dr. Moewardi Hospital, Surakarta, Central Jawa, Indonesia*
[b] *Istituti Clinici Scientifici Maugeri: Scientific Institute, IRCCS, Montescano, Italy*

Received 28 October 2017; accepted 26 January 2018

KEYWORDS
Exercise training;
Dyspnea;
Quality of life;
Exercise tolerance;
Physical activity

Abstract
Background and objective: There are barriers to providing pulmonary rehabilitation for chronic obstructive pulmonary disease (COPD) such as the high number of patients, difficult access to health facilities and high costs of programs. Pedometers can monitor and improve physical activity (PA). The aim of this study was to evaluate benefits and costs of home pedometer assisted PA, as compared to a standard outpatient supervised exercise training program in patients with COPD.
Methods: Patients were randomly assigned either to home pedometer assisted PA (Group 1), or to a six-week outpatient standard supervised exercise training program (Group 2). Patients of Group 1 had to walk at home for 6 weeks, at least 30 min daily at the fastest step pace as possible, to achieve a weekly 10% increase in their average daily steps up to more than 6500. Pre and post programs we assessed: the six minute walking distance (6MWT: primary outcome), daily steps count, the Medical Research Council scale (MRC), the COPD assessment test score, and the BODE index (body-mass index, airflow obstruction, dyspnea, exercise capacity). Costs of programs were also evaluated.

Abbreviations: 6MWT, six-minute walking test; ATS, American Thoracic Society; BMI, Body-mass Index; BODE, Body-mass index, airflow obstruction, dyspnea, and exercise capacity index; CAT, COPD Assessment Test; CONSORT, Consolidated Standards of Reporting Tables; COPD, chronic obstructive pulmonary disease; ERS, European Respiratory Society; FEV_1, Forced Expiratory Volume at one second; GOLD, Global Initiative for Chronic Obstructive Pulmonary Disease; HRQL, health-related quality of life; IDR, Indonesian rupiah; MCID, Minimum Clinically Important Difference; MRC, Medical Research Council score; PA, physical activity; QALY, quality adjusted life years; RCT, Randomised Controlled Trial; SD, Standard Deviation.

* Corresponding author.
E-mail address: dr.kikiwidy@gmail.com (K. Widyastuti).

https://doi.org/10.1016/j.pulmoe.2018.01.006

Results: Out of 40 patients, 18 in both groups (mean (standard deviation)) age: 68.3 (6.7) and 61.2 (6.7) years; FEV1: 1.1 (0.5) and 0.9 (0.4) liters in Group 1 and 2 respectively completed the study. At the end of the program 44.5% patients of Group 1 had reached the target daily steps, in 26.6 (9.5) days. Following the programs, both groups showed significant improvements in all outcome measures, except BODE. The home program was cheaper ($p = 0.0001$), with a mean 76.3 euros saving per patient.
Conclusion: Home pedometer assisted PA may be a useful and cheaper alternative to outpatient supervised exercise training programs in patients with COPD.

Introduction

Total tobacco-attributable deaths including those due to chronic obstructive pulmonary disease (COPD), a leading cause of mortality and morbidity worldwide are projected to rise from 5.4 million in 2005 to 8.3 million in 2030.[1–4] Prevalence and mortality rate are forecasted to increase due to the increasing number of smokers.[2–6]

Higher physical activity (PA) is associated with lower risk of mortality and cardiovascular events in individuals from low-, middle-, and high-income countries.[7] Daily PA of patients with COPD is reduced in the early phases of disease as compared to healthy age-matched controls[8] and worsen over time, with important clinical consequences.[9] In these patients pulmonary rehabilitation improves symptoms, exercise capacity and health-related quality of life (HRQL),[10,11] although the observed benefits do not consistently translate into enhanced PA levels.[12] As a consequence guidelines for management of COPD suggest that pulmonary rehabilitation including exercise training should be provided to the vast majority of patients.[1]

In many countries, there are barriers to hospital based inpatient and outpatient supervised exercise training programs, such as a high number of patients, transportation, program costs, and geographical obstacles.[13] A home program consisting of 3 weekly sessions for 8 weeks of aerobic leg cycling and strength exercises was a useful, equivalent alternative to outpatient rehabilitation for patients with COPD.[14] Also tele-rehabilitation programs may be potentially useful to deliver and to maintain the benefits in difficult-to-reach areas.[15,16]

The daily steps and activity time were proven to be the most valid measurement of PA[17,18] and their regular monitoring may benefit patients with COPD in achieving the effective daily PA.[18] Pedometers have greatly advanced in recent years, providing daily step estimates,[18] and smartphones with miniaturized accelerometre apps measuring PA are universal, widespread technologies which many patients with COPD may not use as they probably should.

We hypothesized that a home pedometer assisted program to incentivize PA might be an alternative to hospital based outpatient exercise training programs, especially in the context of regional asymmetries and difficult access to health facilities (as is the case of Indonesia with a 4.5% COPD prevalence,[5] and a population of about 260 million – about 35 million living in Central Jawa, the others living on more than 17 000 islands with limited access to health services[19]). The aim of this study was to evaluate the effect on exercise capacity, PA, dyspnea, and health status as well as costs of home pedometer assisted PA, as compared to a standard outpatient supervised exercise training program in patients with COPD.

Methods

Study design

This was a randomized clinical trial (RCT). During the first week, all patients were taught how to use pedometers in three face to face sessions with a researcher checking patients' ability to use the device properly. After the training week, subjects were randomly assigned to two groups: the Study Group (Group 1) received an unsupervised home pedometer assisted PA program, the Control Group (Group 2) received a hospital based outpatient supervised exercise training program. Researchers evaluating results and patients were not blind to treatment. Patients maintained their usual drug medication during the entire study.

The study was performed according to the Helsinki Declaration and approved by the Ethics Committee of Dr. Moewardi Hospital, Surakarta, Central Jawa, Indonesia (Reference: 799/IX/HREC/2016). Written informed consent to participate was obtained from all participants.

Study participants

Stable patients suffering from COPD as defined by the Global Initiative for Chronic Obstructive Pulmonary Disease (GOLD) guidelines,[1] 40–75 years old, were consecutively recruited from the outpatient clinic of Dr. Moewardi Hospital, Surakarta, Central Jawa, Indonesia, between October 2016 and January 2017. Patients were enrolled if in a stable clinical condition (no exacerbation in the 4 weeks prior to study). The exclusion criteria were refusal to participate, participation in a pulmonary rehabilitation program during the previous 6 months, and severe concomitant comorbidities such as ischemic cardiac disease, chronic heart failure, orthopedic and/or neuromuscular diseases interfering with their ability to walk.