Rev Port Cardiol. 2018;xxx(xx):xxx–xxx

Revista Portuguesa de Cardiologia
Portuguese Journal of Cardiology
www.revportcardiol.org

REVIEW ARTICLE

Measurement of physical performance by field tests in programs of cardiac rehabilitation: A systematic review and meta-analysis☆

Cristiane Travensolo[a], Karla Goessler[b], Roberto Poton[a], Roberta Ramos Pinto[a], Marcos Doederlein Polito[a,*]

[a] *Departamento de Educação Física, Universidade Estadual de Londrina, Londrina, PR, Brazil*
[b] *Research Centre for Cardiovascular and Respiratory Rehabilitation, Catholic University of Leuven, Leuven, Belgium*

KEYWORDS
Exercise test;
Physical conditioning;
Cardiovascular physiology

Abstract
Introduction: The literature concerning the effects of cardiac rehabilitation (CR) on field tests results is inconsistent.
Purpose: To perform a systematic review with meta-analysis on field tests results after programs of CR.
Methods: Studies published in PubMed and Web of Science databases until May 2016 were analyzed. The standard difference in means correct by bias (Hedges' *g*) was used as effect size (*g*) to measure que amount of modifications in performance of field tests after CR period. Potential differences between subgroups were analyzed by *Q-test* based on ANOVA.
Results: Fifteen studies published between 1996 and 2016 were included in the review, 932 patients and age ranged 54.4-75.3 years old. Fourteen studies used the six-minutes walking test to evaluate the exercise capacity and one study used the *Shuttle Walk Test*. The random Hedges's *g* was 0.617 ($p<0.001$), representing a drop of 20% in the performance of field test after CR. The meta-regression showed significantly association ($p=0.01$) to aerobic exercise duration, i.e., for each 1-min increase in aerobic exercise duration, there is a 0.02 increase in effect size for performance in the field test.
Conclusion: Field tests can detect physical modification after CR, and the large duration of aerobic exercise during CR was associated with a better result.

☆ Please cite this article as: Travensolo C, Goessler K, Poton R, Pinto RR, Polito MD. Medida do desempenho físico por testes de campo em programas de reabilitação cardiovascular: revisão sistemática e meta-análise. Rev Port Cardiol. 2018. https://doi.org/10.1016/j.repc.2017.07.008

* Corresponding author.
E-mail address: marcospolito@uel.br (M.D. Polito).

PALAVRAS-CHAVE
Teste de exercício;
Condicionamento físico;
Fisiologia cardiovascular

Medida do desempenho físico por testes de campo em programas de reabilitação cardiovascular: revisão sistemática e meta-análise

Resumo
Introdução: A literatura mostra-se inconsistente sobre o efeito da reabilitação cardiovascular (RVC) nos resultados de testes de campo.
Objetivo: Fazer uma revisão sistemática com meta-análise sobre os resultados de testes de campo usados em programas de RCV.
Métodos: Foram analisados estudos publicados nas bases de dados *PubMed* e *Web of Science* até maio de 2016. O tamanho do efeito (*g*) foi definido como a diferença média padronizada corrigida por viés (*g* de Hedges) e foi usado para medir a quantidade de modificações no desempenho do teste após o período de RCV. Diferenças potenciais entre os subgrupos foram testadas pelo teste Q baseado na análise de variância.
Resultados: Compuseram a revisão 15 estudos publicados entre 1996 e 2016, com amostra total de 932 pacientes e idade entre 54,4 e 75,3 anos. Catorze estudos usaram o teste de caminhada de 6 min para avaliar a capacidade de exercício e um estudo usou o *Shuttle Walk Test*. O *g* de Hedges pela análise aleatória foi de 0,617 ($p < 0,001$), representou aumento de 20% no desempenho do teste de campo após a RCV. A metarregressão mostrou associação significativa ($p = 0,01$) para a duração do exercício aeróbio, ou seja, para cada aumento de 1 min na duração do exercício ocorre o aumento de 0,02 no efeito para o desempenho no teste de campo.
Conclusão: Testes de campo identificam mudanças após a RCV e a maior duração do exercício aeróbio durante a RCV se associa com um melhor resultado.

Introduction

Physical exercise is important in cardiovascular rehabilitation (CR). The physical assessment of patients before starting treatment is thus essential.[1–5] In this respect, cardiopulmonary exercise testing (CPET) measures several variables related to cardiorespiratory function, including peak oxygen consumption ($VO_{2\ max}$),[6,7] and is considered the gold standard for determining $VO_{2\ max}$.[8–13] However, because it is complex and requires maximum effort, CPET is not commonly used in clinical practice.[8,9,11,13–24] For example, 12% of patients with coronary artery disease are unable to perform the test with maximal effort.[25] Therefore, field tests have been developed to predict $VO_{2\ max}$ and to identify functional limitations, enabling $VO_{2\ max}$ to be used more regularly in clinical practice.

Several field tests are used in CR. The 6-minute walk test (6MWT; the longest distance walked in 6 minutes),[26,27] provides firm evidence of response to clinical changes.[10] It correlates with $VO_{2\ max}$ in CPET in patients with heart failure[28–30] and is sensitive to changes in perception of disease symptoms.[31] Moreover, the Shuttle Walk Test (longest distance walked in a 10-meter corridor with gradual increase in intensity) has been used in post-operative coronary artery bypass grafting (CABG) patients,[32] heart failure patients[33] and in Chagas disease.[34]

Step tests are also used in patients with respiratory diseases[35] suspected coronary obstruction[36] and in elderly patients with heart failure.[37–39] They require little space and are easy to transport and simple to perform.[40]

However, the literature on the effects of CR programs on field test performance is inconsistent. Conductingfurther trials is important and other research models would enable an integrated analysis of published results. In this context, systematically reviewing the literature makes it possible to search for and include references using defined and robust strategies, and a meta-analysis allows a mathematical model to be used to identify potential variables affecting outcome. We did not find any meta-analyses focusing on field tests and CR. As such, the aim of this study was to systematically review the literature on field tests used in CR programs and to perform a meta-analysis to identify (1) the effect of CR on field test performance and (2) training variables that may influence CR effect.

Methods

Search strategy and selection of trials

Two researchers (CFT and RRP) independently conducted a literature review in the *MEDLINE/PubMed* and *Web of Science* databases. Articles were selected from their date of publication up to May 2016. Doubts concerning article selection were resolved jointly by the researchers based on the proposed inclusion criteria. Medical descriptors standardized by Medical Subject Heading were used, along with terms and expressions in the title or abstract. The following inclusion criteria were taken into account: (1) articles in English, including randomized and non-randomized clinical trials; (2) human subjects (men and/or women over 18 years of age); (3) diagnosis of heart disease; (4) participants in outpatient CR programs; (5) exercise capacity evaluated by means of exercise tests independently of CPET; (6) presence of training-prescription variables; (7) control group.