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Cost-Effectiveness of Supervised Exercise Therapy in Heart Failure Patients

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ABSTRACT

Objective: Exercise therapy in heart failure (HF) patients is considered safe and has demonstrated modest reduction in hospitalization rates and death in recent trials. Previous cost-effectiveness analysis described favorable results considering long-term supervised exercise intervention and significant effectiveness of exercise therapy; however, these evidences are now no longer supported. To evaluate the cost-effectiveness of supervised exercise therapy in HF patients under the perspective of the Brazilian Public Healthcare System. **Methods:** We developed a Markov model to evaluate the incremental cost-effectiveness ratio of supervised exercise therapy compared to standard treatment in patients with New York Heart Association HF class II and III. Effectiveness was evaluated in quality-adjusted life years in a 10-year time horizon. We searched PUBMED for published clinical trials to estimate effectiveness, mortality, hospitalization, and utilities data. Treatment costs were obtained from published cohort updated to 2008 values. Exercise therapy intervention costs were obtained from a rehabilitation center. Model robustness was assessed through Monte Carlo simulation and sensitivity analysis. Cost were expressed as international dollars, applying the purchasing-power-parity conversion rate. **Results:** Exercise therapy showed small reduction in hospitalization and mortality at a low cost, an incremental cost-effectiveness ratio of Int$26,462/quality-adjusted life year. Results were more sensitive to exercise therapy costs, standard treatment total costs, exercise therapy effectiveness, and medications costs. Considering a willingness-to-pay of Int$27,500, 55% of the trials fell below this value in the Monte Carlo simulation. **Conclusions:** In a Brazilian scenario, exercise therapy shows reasonable cost-effectiveness ratio, despite current evidence of limited benefit of this intervention.

Keywords: costs, health economics, heart failure, physical therapy.

Introduction

Heart failure (HF) is a common health care problem worldwide, with elevated costs associated to its treatment [1]. During the past 20 years several effective therapies have changed HF management and clinical outcomes and these have been formally evaluated through economic analyses [2-4]. The decrease in HF mortality was followed by an increase in its prevalence, with direct effect on health care budgets resulting from the rising number of hospitalizations and therapeutic procedures [5].

HF is a complex syndrome characterized by reduced exercise tolerance and the involvement of multiple physiopathologic mechanisms [6]. In the past patients were often advised to limit their efforts in daily activities; however, several studies suggest that exercise training may reduce mortality and morbidity in HF patients [7,8]. These studies also demonstrated that exercise training could be performed safely in appropriately evaluated cases of patients who present in clinically compensated New York Heart Association (NYHA) functional class II and III, as endorsed by current guidelines [9,10].

For health care managers, the decision to incorporate exercise therapy in treatment of patients with HF should be based in several perspectives, including cost-effectiveness studies of the intervention. In 2001, Georgiou et al. [11] published a cost-effectiveness analysis of supervised exercise intervention in HF patients showing a very favorable cost-effectiveness ratio of $1773 per life-year saved, considering a 14-month period of supervised exercise intervention in a time horizon of 10 years applied to a North-American setting.

Recently a multicenter randomized controlled trial of 2331 HF outpatients [12] described an exercise-based intervention being compared with standard treatment. After 2.5 years of follow-up, including a short training period in a facility followed by home-based exercise sessions, a benefit was observed only after adjustment for other prognostic predictors of the primary endpoint. The authors concluded that exercise training is a safe intervention associated with a modest reduction in hospitalization and mortality,

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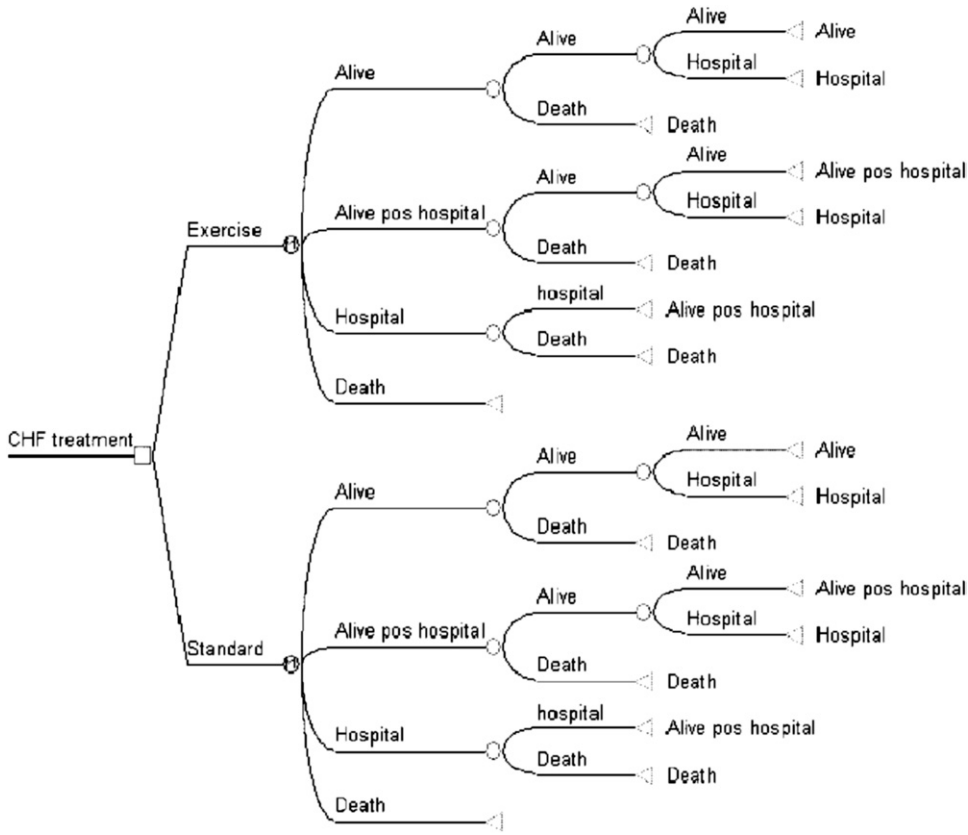

Fig. 1 – Schematic representation of the decision model.

far from the assumed estimations in previous cost-effectiveness analysis [12].

In this study we evaluated the economic impact of a supervised exercise intervention in a hypothetic stable outpatient HF cohort, considering current evidence of effectiveness and costs, offering health care professionals an updated assessment on the role of exercise in the management of HF.

Methods

Target population

The target population was composed of 60-year old patients at baseline, with clinically stable NYHA class II or III HF, intended to reproduce the population in exercise interventions studies in HF.

Decision model structure

We developed a model based on two competing strategies: 1) standard HF care; and 2) standard HF care plus an exercise-based intervention [13]. We constructed our decision tree model with Markov transitional states using TreeAge Pro 2009 Suite software (release 1.0.1, TreeAge Software Inc., Williamstown, MA), tracking a hypothetical cohort of HF patients over time receiving one of the strategies. During each 1-year cycle, patients could remain alive or die; patients alive could also remain stable or be hospitalized. After having been hospitalized, these patients could die or remain alive, with a lower survival rate, simulating the natural history of HF. In the intervention arm we assumed that exercise could reduce mortality and hospitalization rates, according to expected rates of effectiveness. We computed all-cause mortality in our model, considering evidence of exercise intervention studies. A schematic representation of our decision tree is shown in Figure 1.

The discount rate for both cost and effectiveness was 5% per year. We used the public third-party payer perspective and a 10-year time horizon.

Survival data

Survival rates were based in data from a specialized HF outpatient clinic from a university hospital in Brazil whose patients' characteristics are similar to the exercise intervention studies' populations. This cohort was composed of 318 patients (68% men), with a median age of 61 years (interquartile range 50–71 years). Thirty-seven percent of patients had ischemic heart disease as the HF etiology; 87% were currently taking beta blockers, and 91% were taking angiotensin converting enzyme inhibitors. The prevalence of diabetes mellitus in this cohort was 30%, 41% of these patients had hypertension, and 11% were tobacco users. The annual rate of hospital admission in this cohort was 16%, and patients who had been hospitalized had a diminished survival rate compared with those who had not been hospitalized [14].

Median follow-up of this cohort was 75 months (95% confidence interval [CI] 68–81). To project survival during the 10-year time horizon, we built a survival curve (Fig. 2) using a Weibull function. Two different curves were built based on hospitalization status. The final equations for the survival functions were Exp(−((0.0004*(_stage)^1.0715)) in nonhospitalized patients and Exp(−((0.00018*(_stage)^1.3627)) in hospitalized patients.