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Intervention

The effects of a transtheoretical model-based exercise stage-matched intervention on exercise behavior in patients with coronary heart disease: A randomized controlled trial

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ABSTRACT

Objective: To determine whether a transtheoretical model-based exercise stage-matched intervention (ESMI) has positive effects on the exercise behavior of sedentary patients with coronary heart disease (CHD).

Methods: The study was a randomized controlled trial with a repeated measures design. Participants ($N = 196$) were randomly allocated to either a conventional (C) group, a patient education (PE) group, or an ESMI group. Exercise behavior was measured by exercise stages of change, exercise self-efficacy, exercise decisional balance, and duration of moderate exercise at baseline, immediate post-intervention, and at 3- and 6-month follow-up.

Results: Our results showed that the ESMI group demonstrated a more positive shift in exercise stages of change ($p < 0.01$), higher exercise self-efficacy ($p < 0.01$), greater exercise benefits ($p < 0.01$), fewer exercise barriers ($p < 0.01$), and longer moderate exercise duration (minutes/week) ($p < 0.01$) after completion of the 8-week intervention compared with the C and PE groups. These significantly positive effects were maintained at 3- and 6-month follow-up.

Conclusion: The transtheoretical model-based ESMI had significantly positive effects on the exercise behavior of sedentary CHD patients.

Practice implications: It is important to provide a structured education program for CHD patients, preferably guided by the transtheoretical model.

1. Introduction

Although the World Health Organization (WHO) emphasizes primary and secondary preventions of coronary heart disease (CHD), CHD is still a leading cause of death and disability among adults worldwide and has now become the third leading cause of death among Chinese adults [1].

Exercise-based cardiac rehabilitation has been found to benefit cardiac patients [2,3]. However, patients' participation in, and adherence to rehabilitation programs have been disappointing. Several studies reported that only 3.8% to 38% of patients with CHD participated in formal cardiac rehabilitation programs [4–6]. Of those who participated in such programs, the dropout rate reached approximately 50% during the first six months [7,8]. Thus, interventions to improve the uptake of, and adherence to, exercise-based cardiac rehabilitation programs are imperative.

Previous studies have shown that the transtheoretical model (TTM) [9], sometimes called the stages of change model, is an effective model for changing exercise behavior in various populations, ranging from adolescents [10] to older people [11,12]. The TTM consists of four core constructs: stages of change, processes of change, self-efficacy for behavioral change, and decisional balance. Based on the stages of change, individuals are divided into one of five stages: precontemplation (no intention

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to start exercise in the next six months), contemplation (being aware the problem exists and thinking about starting exercise), preparation (currently engaging in some exercise, but not regularly), action (successfully exercising regularly for less than six months), and maintenance (exercising regularly for more than six months) stages [13]. The TTM offers a promising approach to integrating the stages and processes of change (strategies and techniques). According to the stages of change, researchers can develop stage-matched interventions, which refer to strategies and techniques that are matched to the individual's current stage of behavioral change. Exercise Stage-Matched Intervention (ESMI) refers to strategies and techniques that are matched to the individual's current stage of readiness for changing his/her exercise behavior [14].

Although the TTM is theoretically sound, few studies have been conducted to examine the effects of the TTM-based intervention on exercise behavior among heart disease patients [15]. Our literature review found only four studies that had used the TTM to motivate heart disease patients to exercise. These four studies had inconsistent conclusions about adherence to regular exercise and all of them recruited participants immediately after they had completed a formal cardiac rehabilitation program [16–19]. Clearly, all of the participants were likely to have been in the preparation, action, or maintenance stage at the time of entering the study, which means that they were ready to change their behavior or already active at baseline. According to the TTM, the strategies and techniques used to motivate individuals in the precontemplation or contemplation stage to change their behavior are different from those in the action or maintenance stage [9]. Thus, the question of whether a TTM-based ESMI is effective in motivating sedentary CHD patients, who are in the precontemplation, contemplation, and preparation stages, to engage in exercise remains to be answered.

The aim of this study was to determine whether a TTM-based ESMI had a positive effect on the exercise behavior of sedentary CHD patients. The hypotheses of this study were set in accordance with exercise stages of change (ESC), exercise self-efficacy (ESE), exercise decisional balance, and exercise duration: Compared with the Conventional (C) and Patient Education (PE) groups, patients in the ESMI group would have: (i) a more positive shift in ESC; (ii) higher ESE; (iii) greater exercise benefits and fewer exercise barriers; and (iv) longer moderate exercise duration (minutes/week) after participating in the program.

2. Methods

2.1. Study design

This was a three-group, repeated measures, randomized controlled trial. A total of 196 eligible patients were recruited and the patients at each stage were randomly allocated to one of the following three groups: the C group ($n = 67$), the PE group ("sham" group) ($n = 64$), or the ESMI group ($n = 65$) using a random number table. Data were collected at baseline (T_0), immediate post-intervention (T_1), and 3-month (T_2) and 6-month (T_3) follow-up by a registered nurse who was blind to the study's design, group assignment and intervention implementation.

2.2. Participants

This study was conducted in three tertiary hospitals in Xiamen City, a large urban city in Southern China. Xiamen City has a population of more than 3.5 million, of which 82.6% aged 15–64 years and 4.6% aged 65 years or older [20]. The gross domestic product (GDP) of Xiamen City has been steadily increasing in the past few years and the City's GDP of the first half of 2013 was US$ 21.06 billion [21]. There was no cardiac rehabilitation program for cardiac patients in Xiamen City and the three participating hospitals provided similar conventional care.

Patients were included if they had been diagnosed with myocardial infarction or angina pectoris (ICD9: 410–413) by a cardiologist (based on patients' medical history and investigations of electrocardiograph, serum enzyme, and/or coronary angiography) for at least three months, or they had undergone percutaneous coronary intervention (PCI) for at least three months; were medically stable; were sedentary (according to Centers for Disease Control and Prevention [22], individuals with no or irregular physical activity were defined as having a sedentary lifestyle, and thus patients at the precontemplation, contemplation and preparation stages were included); aged 18 years or older; were able to communicate and read in Mandarin; and were available for receiving intervention and follow-up.

Patients were excluded if they had previously participated in a cardiac rehabilitation program; had cognitive impairment (e.g., dementia) or psychiatric illnesses (e.g., psychosis); had depression, that is, their scores on the Hospital Depression Subscale (HADS-D) was equal to or higher than 11 [23]; and had any contraindications for exercise training, such as unstable angina, critical aortic stenosis, and uncontrolled symptomatic heart failure (e.g., New York Heart Association Classification [NYHA] III/IV) [24].

The study was designed to have 80% power with a medium effect size of 0.25 for ANOVA analysis [25] among the three groups ($u = 2$) and 20% attrition rate [26] at the 5% significance level with two-tailed test. Thus, 189 patients were required (63 in each group) [25].

2.3. Interventions

Patients in the C group received only conventional care provided by the hospitals. Patients in the PE group received conventional care, a two-hour patient education session and a booklet about cardiac rehabilitation (which had been developed by the Hong Kong Cardiac Rehabilitation and Prevention Centre of Tung Wah Hospital and the organisation, Care for Your Heart), and eight weekly sessions of general patient education about exercise either via face-to-face or telephone contacts based on the availability of the patients; but each patient must receive two sessions of face-to-face contact. Patients in the ESMI group received conventional care, a 2-h patient education session including the booklet about cardiac rehabilitation (same as that of the PE group), and eight weekly sessions of ESMI together with exercise stage-matched pamphlets. The detailed descriptions of interventions in the three groups are shown in Table 1.

The ESMI was implemented according to the TTM with consideration of the characteristics of CHD patients and Chinese culture. The ESMI was implemented weekly for eight weeks either via face-to-face or telephone contacts (same as that of the PE group). An eight-week period was selected based on previous studies using the TTM for exercise behavioral change [14,27]. During the eight-week intervention period, the researcher (L-XZ) assessed each patient's exercise of stages of change weekly according to the exercise stages of change scale [28] before delivering the ESMI. Different strategies and techniques were used for patients at different stages of change. In formulating the ESMI, the guidelines (Table 2) were set with reference to those developed by Burbank and colleagues [11]. The proposed study design was piloted on 18 sedentary CHD patients before commencement of this study and showed feasibility and appropriateness of the intervention for CHD patients.

2.4. Outcome measures

At baseline, patients' demographic information was obtained and their clinical variables were extracted from medical records.