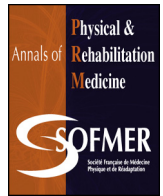




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Original article

## Barriers to physical activity in coronary artery disease patients: Development and validation of a new scale

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### ABSTRACT

**Objective:** To develop and validate a self-report questionnaire to measure barriers to regular physical activity (PA) in patients with stable coronary artery disease (CAD).

**Methods:** Phase 1: 17 patients completed a semi-structured interview. After grouping and reformulating the reported barriers, their pertinence was reevaluated by the patients. Then, a decision algorithm was used to select items. A principal component analysis was performed to determine content validity. Phase 2: 49 patients completed the questionnaire resulting from phase 1 twice, 7 days apart, and questionnaires to evaluate depression, anxiety, and the level of physical activity. Construct validity was evaluated by analysis of Spearman's correlation coefficient between the total score for the questionnaire and a convergent dimension (anxiety), as well as a divergent dimension (Dijon physical activity score). Internal consistency was evaluated by Cronbach's alpha coefficient. Test-retest reliability was evaluated by the intraclass coefficient (ICC).

**Results:** Eleven items were selected after phase 1. The questionnaire presented good face validity and the content validity seemed satisfactory after analysis of the literature by the experts. Construct validity was moderate. Internal consistency was very good (Cronbach's  $\alpha > 0.81$ ). Reproducibility was excellent with an ICC at 0.95. Feasibility was good with less than 3 minutes to complete the questionnaire.

**Conclusion:** This questionnaire presents good psychometric properties. A further prospective study should evaluate sensitivity to change and help determine a threshold value indicating the need for a specific behavioral strategy to alleviate barriers to physical activity in these patients.

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### 1. Introduction

Coronary artery diseases (CAD) are increasing in developed, as well as developing countries, with a worldwide prevalence ranging from 11.9 and 10 percent for men and women, respectively, at age 20–39, up to 84.7 and 85.9% over 80 years old [1]. In addition, even though these diseases remain the leading cause of death in the

world [2], they are also one of the principal causes of limited activity and restricted participation [3]. This is mainly due to decreased fitness, which impairs quality of life and socio-professional integration of these patients [3]. The benefits of physical activity (PA) after acute coronary syndrome (ACS) are now well known. It has notably been shown that cardiac rehabilitation programs, based on regular appropriate physical activity decrease mortality by 30% [4]. Moreover, it has been clearly established that better tolerance to effort is associated with a reduction of total mortality in these patients [5]. CAD patients are thus encouraged to schedule regular PA in the long-term. PA must be associated with modifications in lifestyle habits (diet, stress management, stopping smoking) to obtain optimal control of cardiovascular risk factors, and thus, to improve their physical capacity, social

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integration and quality of life. One of the principal challenges of secondary prevention in these patients remains to obtain a durable modification in their lifestyle habits, especially with a return to regular PA [6]. Despite this, the vast majority of patients do not achieve PA in accordance with recommendations, even when they benefited from a structured PA program associated with therapeutic education sessions in the context of a cardiac rehabilitation program [7]. This limited return to PA in secondary prevention may be the result of numerous barriers, which discourage them from exercise. Indeed, several studies suggest that even though objective factors such as comorbidities, age, tolerance to exercise and social and ethnic origin must be taken into account, they explain only a part of the lack of participation in PA. Other perceived factors like the perceived state of health, self-care abilities and anxiety-depression also influence the level of PA, at least as much as the state-of-health objective [8,9]. These elements could be positively influenced by a behavioral approach to remove these barriers to the regular practice of PA. However, before developing behavioral interventions, it is necessary to identify the factors that significantly hinder regular PA in this population; this is the first step towards their elimination [10]. To date, there are no clinical tools for the reliable and rapid evaluation of barriers to PA after ACS in these patients, similar to those proposed for diabetic patients [11].

The aim of this work was to develop and validate a simple questionnaire to measure in a reliable manner perceived barriers to regular physical activity in patients with stable CAD (BAPAC questionnaire), so as to identify potential targets for future interventions and to personalize optimal clinical follow-up in secondary prevention.

## 2. Method

This was a prospective study, conducted jointly by the Cardiology Department of Dijon CHU, the Cardiac Rehabilitation Unit of Dijon CHU and the Heart and Health Club (Club cœur et santé). This study was carried out with the agreement of the ethics committees (CPP of Dijon and the CNIL). Consent was collected for each participant.

The study was divided into two phases: phase 1, which aimed to generate and select items for the questionnaire and phase 2, which aimed to study the psychometric properties of this questionnaire.

### 2.1. Population

The inclusion criteria were as follows:

- patients with stable coronary artery disease;
- more than 4 weeks after an acute coronary syndrome or a revascularization procedure for unstable angina (percutaneous dilation/stent or coronary artery bypass graft: CABG) without a post-procedural complication.

These patients were successively included on a voluntary basis. They included three different subpopulations:

- patients referred for a cardiac rehabilitation program at the Rehabilitation Unit of Dijon CHU (CR group);
- patients with stable CAD followed at the Cardiology Department of Dijon CHU, who had never taken part in a of secondary prevention program in the wake of a coronary event (CC group);
- regular members of the Heart and Health Club (phase III activities) for more than one year (CH group).

Patients presenting the following were excluded:

- acute coronary event < 1 month;
- chronic systolic heart failure (defined by a left ventricular ejection fraction at rest < 40%);

- symptomatic aortic stenosis, non-revascularized severe coronary artery disease;
- patients awaiting CABG or presenting chronic atrial fibrillation, or fitted with a permanent ventricular pacemaker were also excluded;
- malignant arrhythmia occurring on effort;
- pregnant or breast-feeding women;
- impaired executive functions, making it impossible for the patient to understand and comply with the research protocol (MMSE < 24), or insufficient skills in written or spoken French;
- chronic motor deficiency limiting capacity to effort and predominantly of neurological origin (examples: sequelae of stroke, balance and coordination disorders), or of osteo-articular origin (examples: severe knee or hip osteoarthritis);
- severe medical disorder significantly affecting functional abilities (respiratory insufficiency, non-stabilized metabolic disorders, such as progressive kidney failure) and potentially life-threatening diseases in the short or medium term (progressive cancer, non-stabilized systemic disease).

The same criteria were used for phase 2 and patients from phase 1 were excluded.

### 2.2. Protocol

#### 2.2.1. Phase 1: creation of the “BAPAC” questionnaire (barriers to appropriate physical activity in CAD patients)

**2.2.1.1. Initial interview (T0).** Patients had a 30-minute semi-structured interview, conducted by a physician experienced in the management of patients in secondary cardiovascular prevention. The interviewer tried to discover the principal barriers spontaneously divulged by the patient concerning regular PA according to the recommendations, by an open question “In your opinion, what could prevent you from achieving regular physical activity in the next six months?”. The interviewer also presented the principal barriers reported in diabetic patients according to the BAPAD questionnaire [11,12], which were applicable in the CAD population, to know if the patient found them relevant: 9 items of the BAPAD were selected beforehand by two independent expert physicians, who found them appropriate for our study as they were applicable to CAD patients. Five-level Likert scale ranging from 1 (very unlikely) to 5 (very probable).

**2.2.1.2. Intermediate analysis.** Following the first semi-directed interview, the analysis of the content was interpreted independently by two experts, who grouped the responses that seemed to belong to the same category, then reworded the items using the patients’ vocabulary to facilitate understanding (eg: back pain, pain in the knee, arthritis designed as “joint pain”).

**2.2.1.3. Second interview (T1).** Seven days later, the patients were interviewed by telephone and asked to evaluate the reformulated items selected by our experts on a 5-level Likert scale ranging from 1 (very unlikely) to 5 (very probable)..

**2.2.1.4. Selection of the BAPAC items.** Items were selected according to a precise protocol. In the first step, items judged not relevant after the interviews were removed, as were redundant items: items were deemed redundant if there was a major correlation shown by a Spearman correlation coefficient > 0.85. In the same way, items with no variance were de-facto eliminated during this step. The experts then created an algorithm to select the most pertinent items for our questionnaire using the following elements:

- for the whole sample: the frequency the item was mentioned, scored from 1 to 3:1 point for a frequency below 3 responses,

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