

# Usability studies of an innovative rehabilitation device for post-infarction patients – the perspective of rehabilitation nurses

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## Introduction

Cardiovascular pathology is one of the main causes of death in Portugal, particularly acute myocardial infarction (MI), with a mortality rate between 17% and 45% of patients admitted to hospitals. In addition, in the long term, limitations in the performance of Activities of Daily Living (ADL) may arise, since MI causes great levels of fatigue and functional disability, in addition to fear and anxiety.

Moreover, when institutionalized, people in a post-infarction situation are often bedridden, which contributes to a generalized degradation of muscle strength and functionality.

In this sense, Cardiac Rehabilitation (CR) is an intervention indicated especially for patients who have suffered an MI, allowing them to recover autonomy and ability to perform ADLs. However, CR is often ineffective and, in a situation of bed rest, not always the most adequate and efficient.

Recent studies aimed to develop or improve devices to improve the quality of care, its effectiveness, efficiency and safety. Nurses, as professionals who fully understand the needs of the person and who have advanced knowledge of the design and maintenance of specific interventions, are in a privileged position to contribute to the development of innovative prototypes. With this purpose, a device called Ablefit has been developed in the Health Sciences Research Unit: Nursing (UICISA:E), of the Nursing School of Coimbra (ESEnfC), designed for physical exercise in bed. It currently has two functional prototypes – the alpha and the beta models.

## Objectives

Assess the usability and ergonomics of Ablefit: alpha prototype and beta prototype for patients after acute myocardial infarction; identify the main limitations

of both prototypes; and make recommendations for the improvement of future prototypes.

## Materials and Methods

A qualitative method was used, through Focus Groups with Specialist Nurses in Rehabilitation Nursing (EEER). To assess and analyze the main results, the research team used the method proposed by Bardin, with the help of ATLAS.ti v7 software.

## Results

Three focus groups were carried out, with a total of 16 participants. The content analysis uncovered twelve categories (defines a posteriori): (i) therapeutic adherence and motivation; (ii) application areas; (iii) biofeedback; (iv) features to be incorporated into current prototypes; (v) home and autonomy of the patient and caregiver; (vi) safety, ergonomics and ease of use; (vii) factors that facilitate the practice of EEER; (viii) physical exercise program; (ix) cardiac rehabilitation; (x) advantages and disadvantages of the concept underlying Ablefit; (xi) advantages and disadvantages of the alpha prototype; (xii) advantages and disadvantages of the beta prototype.

According to the rehabilitation nurses, both prototypes are safe, easy to use and quick to learn, with great potential to be effective in the contexts for which they were developed. It's possible to conclude that the best solution, and the most innovative, is to merge both concepts in one and, therefore, enhance the best characteristics of each one. In this sense, it is necessary to favor the use of cycloergometry and, consequently, the inclusion of components that facilitate and stimulate the performance of aerobic exercises, with progressive resistance, which allows to increase the functional capacity and muscular strength.

Regarding to biofeedback, the improvement of the device involves the introduction of sensing and monitorization of parameters such as vital signs, and more specific ones such as heart rate variability (HRV) and VO<sub>2</sub>Máx. Still, it is advantageous to include, from the perspective of diagnosis, plan design and prevention, the possibility of conducting functional tests such as the Timed-Up-and-Go Test (TUGT) or the 6 Minute Walk Test, in addition to subjective effort perception tests such as the Borg Scale.

Regarding safety, nurses advised to develop a prototype with parameterized levels that decrease, increase or totally stop the exercise intensity, according to the desired goals or persons' sense of fatigue.

Finally, and as far as the person's autonomy is concerned, the possibility of sending data to an external and independent device (a mobile app, for example), which allows the patient to understand his evolution from hospitalization to homecare and maintain the developed program there.

## Conclusion

The study was very useful to test the usability of Ablefit and to make recommendations for its future development, also contributing to the better effectiveness of Rehabilitation Nursing care in the context of cardiac pathology. Furthermore, it is considered that Ablefit allows the enhancement of EEER, taking into account specific competences, namely teaching, instructing and training on techniques and technologies to maximize performance at motor, cardiac and respiratory levels, as well as promoting innovative strategies for the prevention of clinical risk.