The Development of a Digital Tool for Planning Physical Exercise Training During Cardiac Rehabilitation

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Abstract

In this work, we describe the conceptualization and development of a digital tool to support patients in adhering to prescription of physical exercise training during cardiac rehabilitation. To meet the need for an individual and trackable heart-healthy training plan – which became even more evident during the Coronavirus pandemic – the Activity Planning Tool was developed within a user-centered design process. Tackling the relationship between rehabilitation professional and patient, it allows to jointly set up, monitor, and regularly review a personalized physical activity plan.

Keywords:

Digital health, exercise, cardiovascular diseases

Introduction

The COVID-19-related lockdown in Austria highlighted the need for digital support also for patients with cardiovascular disease (CVD) to assure continued cardiac rehabilitation in a safe and effective manner e.g. at home. Responding to this situation, we initiated a user-centered design (UCD) process [1] to conceptualize and develop digital support fostering CVD patients' physical activity.

This work describes the process of developing the first prototype for digital training support in cardiac rehabilitation (Activity Planning Tool, APT) by adopting an explorative and UCD approach, taking account of the two core user groups for such a digital tool, i.e., rehabilitation professionals and patients.

Methods

The conceptualization and development of APT was an explorative and iterative process, consisting of four phases (see Figure 1 for an illustration of the process).

(1) Idea and concept generation: An initial workshop with three researchers and four rehabilitation professionals was conducted to explore ideas for supporting CVD patients in conducting physical exercise training. In this workshop, rehabilitation professionals pointed out a predominant need for a tool to support activity planning. Subsequently, a co-design workshop with three rehabilitation professionals and five researchers was conducted to deepen researchers' understanding of the outpatient rehabilitation context and practitioners' daily workflow and to identify needs and improvements regarding (digital) activity planning. Patients' perspectives were obtained indirectly by interview data, workshops and rehabilitation professionals' appraisals. As an outcome of this phase, we compiled a detailed collection of contextual information and stakeholders' needs (see Figure 2, left-hand side).

(2) Refinement of idea and definition of requirements: Based on thematic analysis [2], the collected needs were grouped and translated into technical requirements. This resulted in a list of 14 requirements, which were iterated and ranked in a workshop with four researchers. Ranking was done by means of the MoS-CoW method [3] and resulted in the identification of five requirements which were considered most important ("must haves"): activity planning, feedback on performance, goals and status representation, reminder, and individual training recommendations. Based on this, we drew first sketches of the APT (see Figure 2, right-hand side) and developed user stories to communicate the envisioned requirements.

(3) Technical specifications: In order to cross-check the prioritization of requirements and their translation into concrete functionalities of the tool, we conducted lead-user interviews with four rehabilitation professionals. After further iteration with rehabilitation professionals and an expert in software development specification, we were able to define a final specification. Based on this, we developed clickable wireframes for communication with stakeholders and as a detailed design template for developers. Of note, developers were outsourced and therefore integrated in the user-centered design process at a later stage.

(4) Implementation and continuous adaption: Continuous feedback from rehabilitation professionals was collected through the clickable wireframes to the developers, so that additional functionality and changes could be implemented concurrently. The prototype was implemented as both Web- and Native App in Flutter (https://flutter.dev/) and in compliance with the current European General Data Protection Regulation (GDPR).
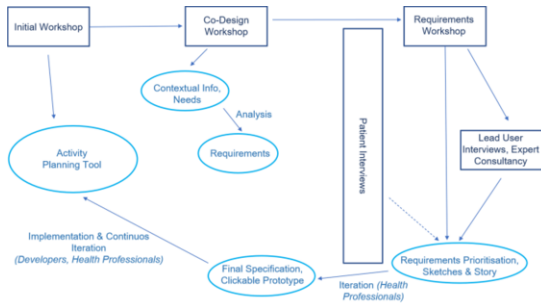
Figure 1 Sketch of APT development according to UCD process including activities and outcomes

Figure 2 Exemplary workshop outcomes: detailed information about context, sketches for activity planning

Results

As a result of a UCD approach, we developed a tool which allows rehabilitation professionals and their patients to jointly set up, monitor, and regularly review a personalized heart-healthy physical activity plan. *Figure 3* illustrates the look and feel of important functionalities for patients using the app on their mobile phones.

Patients are involved and guided by rehabilitation professionals in setting up a personalized physical activity plan. Together with a professional, patients select exercises and activities they enjoy and define personally meaningful goals. Through the app interface, patients can conveniently access their plan on a calendar, log, adjust or add activities, review their performance, and access a library of resources such as exercise videos. At follow-up appointments with their rehabilitation professional, patients can review their documented performance and discuss the plan going forward.

Rehabilitation professionals are supported in providing personalized physical exercise prescription as well as ongoing review and optimization of their patients' performance. Through the web interface, rehabilitation professionals can conveniently view patients' activity logs. Activity logs can be exported and printed, to be filed in medical records, to provide documentation to health insurances, and to be used for joint review and further planning with patients at follow-up appointments.

Figure 3 Characteristic functionalities of the APT: (1) training plan, (2) active minutes and goals, (3) progress over time, (4) training videos, (5) data export

Conclusions

This work summarizes the initial phases of developing a tool which offers a solution for digital support for physical exercise training during cardiac rehabilitation based on a UCD process. For future work, we aim to evaluate this prototype with both patients and rehabilitation professionals in their daily routine.

Acknowledgements

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