

How to support (Long Term) Motivation in Cardiac Telerehabilitation Patients: Guidelines based on Interviews and a Narrative Literature Review

Kyara Fasen

Eindhoven, The Netherlands

k.r.fasen@student.tue.nl

ABSTRACT

Cardiovascular disease continues to be a major cause of morbidity worldwide, and is accounting for approximately 40,000 annual deaths in the Netherlands alone [31]. The medical benefits of participating in a rehabilitation program for cardiac patients have been proven. However long-term clinical effectiveness is often poor because of patients' lack of participation in rehabilitation activities [14].

Telerehabilitation seems to be a promising upcoming alternative to in-hospital rehabilitation with many benefits for patient and hospital alike. But telerehabilitation is still in its starting phase and not yet widely used. Many questions about the use of telerehabilitation remain unanswered. Amongst which how to create this motivation for a patient to finish the rehabilitation program and keep the healthy lifestyle the rehabilitation program advices.

I did a multi-perspective analysis on the topic of (long term) motivation in cardiac telerehabilitation patients. By doing a narrative literature review to gain insights into how (long term) motivation was successfully obtained or how it failed to be obtained in original research papers. I have categorized these insights into themes. Based on these determined themes I conducted semi-structured interviews with cardiac telerehabilitation experts; a cardiologist, nurse specialist and a cardiac patient. To evaluate and enrich the insights from the literature review.

From this analysis I will formulate a list of design recommendations for designers to stimulate (long-term) motivation for their platform users. These recommendations will be assessed on clarity and value by designers working in the cardiac or telerehabilitation field.

By formulating these guidelines I want to contribute to the effectiveness of cardiac tele-rehabilitation for patients.

Author Keywords

Telerehabilitation; cardiology; motivation; design guidelines.

INTRODUCTION

Cardiovascular disease continues to be a major cause of morbidity worldwide, and is accounting for approximately 40,000 annual deaths in the Netherlands alone [31]. But not only the social impact of cardiovascular disease is a burden on our society. It also leaves an economic impact. Healthcare costs associated with cardiovascular disease were estimated

at €6.9 billion in 2007 [28], which is almost 10% of the total healthcare costs in the Netherlands. It is also expected that this economic burden will increase over the next decades, due to our ageing society [21]. However there is an interesting new development taking place in the healthcare industry. Namely the upcoming interest and possibility for telerehabilitation. Cardiac rehabilitation (CR) in general is known to decrease morbidity and mortality rates in cardiac patients [1, 25]. Also the risk of re-hospitalization [16] and re-infraction is known to decrease [23], and progression of the functional limitations of the cardiac disease is known to reduce [11]. So it is clear the medical benefits of participating in a rehabilitation program for cardiac patients have been proven. However long-term clinical effectiveness is often poor because of patients' lack of participation in rehabilitation activities [14]. This is where telerehabilitation (TR) comes in. Comparable results are shown for home-based CR and in-hospital CR with respect to improving physical fitness and health-related quality of life [22]. Home-based CR is also likely to increase overall participation in (exercise-based) CR. Especially for cardiac patients who wish to be able to return to work quickly or who have transportation difficulties. Finally, in-hospital CR appears to have lower societal costs and to be more cost-effective than in-hospital CR [22].

This makes TR seem to be a promising upcoming alternative to in-hospital CR with many benefits for patient and hospital alike. But TR is still in its starting phase and not yet widely used. Many questions about the use of TR remain unanswered. Amongst which how to create this motivation to finish the rehabilitation program and keep the healthy lifestyle the rehabilitation program advices. Because motivation is essential for sustained behavioral change [27, 32].

In this paper I will describe how I did a multi-perspective analysis on the topic of (long term) motivation in cardiac telerehabilitation patients. To find an answer to the question **“What are design guidelines that are interesting for telerehabilitation platform design to use, that potentially help to motivate cardiac patients during telerehabilitation?”**

By doing a narrative literature review I gain insights into how (long term) motivation was successfully obtained or how it failed to be obtained in original research papers. A database search was conducted and 8 articles that met inclusion criteria (original research, published in the past 8 years,

directly related to TR) were selected for review. The results of the literature review allowed me to define themes that show different aspects that influence patient motivation during TR. Based on these determined themes I conducted semi-structured interviews with cardiac telerehabilitation experts; a cardiologist, nurse specialist and cardiac patients. To evaluate and enrich the insights from the literature review.

From this analysis I formulated a list of design recommendations (guidelines) for designers to stimulate (long-term) motivation for their platform users in relation. A preliminary set of these guidelines were assessed on clarity and value by designers working in the CR or TR field.

The formulation of these guidelines is important because these insights can help designers in making design decisions and improve cardiac care. Furthermore, this research is a step forward to showcase the possibilities TR has to offer that can complement centre-based CR.

BACKGROUND

Cardiac Rehabilitation

Cardiac rehabilitation (CR), also called cardiac rehab, is a medically supervised program for people who have had a heart attack, heart failure, heart valve surgery, coronary artery bypass grafting, or percutaneous coronary intervention [5]. It is defined as a secondary preventive program that can include interventions as exercise and patient education on risk factors in order to achieve and maintain a healthy lifestyle [3].

According to the World Health Organization 17.9 million people die from cardiovascular diseases every year. By those numbers it is estimated that cardiovascular diseases cause 31% of all deaths worldwide [34]. In a large and representative community cohort of patients in the Netherlands with an acute coronary syndrome and/or intervention, CR was associated with a substantial survival benefit up to four years [33]. The survival benefit was present among cardiac patients regardless of age, type of intervention, and type of diagnosis [33].

Healthcare professionals involved in CR include doctors, nurses, dietitians or nutritionists, mental health specialists, exercise specialists, and physical and occupational therapists [5]. Sometimes a case manager will help patients with tracking their care [5].

Through involvement of these professionals the rehabilitation of cardiac patients aims to improve patients' recovery, psychosocial well-being, functional capacity, and quality of life by using interventions as physical activity, weight control, improved diet, psychosocial coping, and disease management [20].

The benefits of daily physical activity have been proven [12]. But despite this clinical effectiveness of hospital-based CR, the long term clinical effectiveness is often poor. This is because of the lack of attendance at rehabilitation sessions

and/or nonadherence to recommendations [19]. There is a manifold of reasons patients give for not engaging in rehabilitation activities, but commonly returning reasons are long transportation times, emotional instability, lack of motivation, lack of information about the activities and implementing the CR activities into their daily life [10]. The length of time a patients spends in CR depends on their condition [5] but the Dutch organization 'Hartstiching' explains the average length of the CR program is between 6 and 12 weeks [15]. There are only few risks in the heart-healthy lifestyle changes in CR. But it should be noted that very rarely physical activity during rehabilitation can cause serious health problems. If serious problems occur the rehabilitation team should immediately stop the physical activity and provide appropriate treatment [5].

Telerehabilitation

Telerehabilitation (TR) is the application of telemedicine and telecommunication technology for supporting rehabilitation services [24].

When looking at improving physical fitness and health-related quality of life comparable results are shown for TR and centre-based CR [22]. This shows that home based TR is not inferior to centre-based CR, making TR an appropriate alternative for centre-based CR [18]. The paper 'Clinical and cost-effectiveness of home-based cardiac rehabilitation compared to conventional, centre-based cardiac rehabilitation: Results of the FIT@Home study' even describes that exercise adherence of patients during TR in their study was high and patient-satisfaction was significantly higher than patients in the in-hospital CR group during [22].

TR opens up new possibilities for CR as a service. TR has the possibility to offer patients temporal and logistical freedom to organize their own CR process [8]. Meaning patients will no longer need to consider the time (and expense) of traveling to a rehabilitation center. And offers new possibilities in assisting patients with integrating their CR activities in their daily life, which is important for the coping with lifestyle changes and disease management to be successful [8].

However with current TR programs not yet supporting this incorporation sufficiently enough, the effects of CR are still often not sustained beyond the intervention period because of lack of the lifestyle adaptation [26]. This decline in patients motivation can lead to recurrence of the disease and increased rehospitalization rates [26].

Furthermore TR has the possibility to lower the average cost per patient making offering TR in combination with centre-based CR also financially beneficial for the hospital [13]. However still more research in this area needs to be done to confirm this statement [13].

Motivation

The Cambridge English dictionary defines motivation as the enthusiasm for doing something [4]. In the context of TR within this paper I consider motivation to be just that.

Willingness of the patient to complete the provided CR program and keep working on adopting heart-healthy lifestyle changes to address risk factors for cardiovascular disease.

METHODOLOGY

To explore what design guidelines can be created for TR platform designers to use, information on creating motivation in the context of TR was collected. The study consisted of two phases. In the first phase, a narrative literature review conducted. The review was used as a critical and objective way to analyze the current knowledge on the topic of motivating cardiac patients during TR. The review helped to establish a theoretical framework, and allowed me to identify patterns and themes in the literature. These themes formed by the narrative review were used to optimally shape the interviews that would follow. In the second phase, semi-structured qualitative interviews were conducted based on the themes identified in the first phase. The information gained from the interviews was used to confirm literature findings, to elaborate on insights from the literature, and to bring in new insights into motivating cardiac patients during TR.

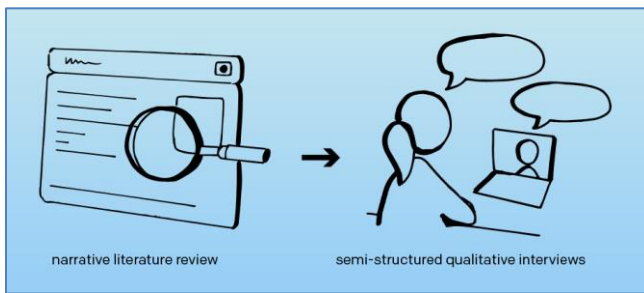


Figure 1. Overview of methods

Narrative review

For the narrative review on creating and maintaining motivation in cardiac patients during TR searches were carried out in Pubmed, ACM Digital library, Researchgate, and Google Scholar. In these databases I used the following search terms collectively:

- “Cardiology” OR “Cardiac Care” OR “Heart Health” OR “HH” OR “Cardiac” OR “CC” OR “Heart failure” OR “Heart Issue” OR “Heart Issues” OR “Heart and Vascular Disease” “Cardiovascular Disease” OR “Cardiovascular”)
- “Motivation” OR “Motivate” OR “Drive” OR “Motivational” OR “Motivational strategies
- “Telerehabilitation” OR “Telerehab” OR “Remote Physical Therapy” OR “Digital health” OR “e-cardiology” OR “tele-rehabilitation”

The search results for both databases were then limited to a publication date between 2012 and 2020. This period covering work from the last 8 years was chosen to get a clear overview of recent developments, as TR and Human computer interaction (HCI) are fast developing and changing

areas. I only selected papers on being written in English and being original research. The search terms are used in the "topic" field during the making of an advance search on the stated databases. This with the exception of Google Scholar as it does not provide to possibility to make an advanced search. The articles are sorted by "relevance". By doing this I made an initial selection of 5 papers based on relevance to the research question. From these 5 papers the references, similar articles as provided by the databases PubMed and ACM Digital library ‘cited by’ list provided by the selected databases, and key reviews were also searched. Out of the papers I came across this way I eventually I selected 8 papers to include in this narrative review that can help answer the research question. Based on 8 articles, published between 2012 and 2020, this report will provide an overview of the current view of the knowledge on how to motivate cardiac patients during TR.

Interviews

Through semi-structured interviews qualitative data was collected. The goal of the interviews was to confirm insights found in the narrative literature review, to elaborate on insights from the literature, and to gain new insights into the experiences of cardiac patients during TR regarding motivation firsthand.

Because this part of the study aimed to clarify data from the narrative literature review and collect more detailed data into why the themes identified in the narrative literature review influence motivation in cardiac patients during TR, semi-structured interviews were chosen as a method. This because it provides the opportunity to directly interact with experts by experience in the topic, and ask questions to reach that deeper level of understanding and collect insightful data. In contrast to other methods it allowed me to respond and ask further questions.

Interviews were conducted with three different types of stakeholders. A cardiologist in training who has experience in guiding patients through TR, a nurse specialist who works as a case manager and is the contact person of patients currently going through TR, and lastly cardiac patients using TR to rehabilitated after their cardiac intervention. These three types of stakeholders were chosen to get a well-rounded view of the situation. Hear personal stories as well as stories from professionals who can sketch a more generalized image.

With exception of the interview with the nurse specialist, all interviews were conducted over the phone, because of the current situation with Covid-19, to ensure social distancing. During the expert interviews were audio recorded after permission for this was granted through signing a consent form. During the patient interviews quotes where written down.

The interviews were transcribed and coded. The qualitative dataset was analyzed through a thematic analysis. This was done to find regularities and correlations in the data, and

bring the insights from the interviews in relation to the insights from the narrative literature review.

Participants

The participants for the expert interviews were recruited through convenience sampling. Connection with the cardiologist in training and the nurse specialist were made by an associate professor at the Technical University of Eindhoven through their connections with the local hospital. First contact with the participants was established through email. Later the interview with the cardiologist in training was conducted through a google teams connection. The interview with the nurse specialist was conducted at location in person.

Participants for the patient interviews were recruited based on convenience and heterogeneity. Cardiac patients currently partaking in a TR program (n=3) were contacted by the nurse specialist I spoke for the expert interviews. These patients have been following a TR program because of the current situation with Covid-19. The patients do not use a platform for TR but are in contact with the health care professionals in the hospital through phone and email connection. The patients were all different in age and in their opinion on TR (positive/negative). The cardiac patient who completed his TR program (n=1) was contacted by the cardiologist in training I spoke for the expert interview. This patient did use a platform for TR and was positive towards TR.

In total four patients participated in the research (three female, one male). All participating patients are cardiac patients who use(d) TR after their intervention. All four participants were interviewed over the phone. In total 6 participants participated in the research. Before starting the research, the six participants were asked to read and sign an informed consent form (Appendix B). An ethical review was checked to comply with the ethical rules of the Technical University of Eindhoven. The participants were anonymized using a number. The anonymized data is stored locally on a computer for analyzing.

RESULTS

Narrative review

The 8 papers included in the review were read, notes taken and key themes regarding their experiences with motivation of (cardiac) telerehabilitation patients were identified. The following sections reflect this categorization: Competency; Autonomy; Relatedness; Stress; and Goal Achievement. The studies highlighted in the sections below were selected as those primary research studies most relevant to the central question of motivation of cardiac telerehabilitation patients.

Competency

A number of studies talk about competency (having the necessary knowledge and skills) as an important aspect of initiating motivation in telerehabilitation patients.

‘Competency’ is also named in the Self-Determination Theory [6] alongside ‘autonomy’ and ‘relatedness’ as the three basic psychological needs that when fulfilled seem to form the basis for autonomous motivation [30]. When it comes to technology-supported interventions, it is important to design systems that are user-friendly and accessible for all patients [26]. The consideration of patient specific needs and perspectives can facilitate the tailoring of TR interventions to its patients [26]. For example using a single access point for TR will provide patients with a necessary and much valued sense of coherence [8]. Also mobile devices and self-tracking devices were preferred for monitoring everyday activities [7].

It is important to note that if technology is not functioning the way it is supposed to it is experiencing by patients as stressful [17]. This stress is usually caused by a low sense of confidence in their own capabilities. Low sense of competence can also limit patients in completion of the physical exercises [17]. However sufficient feedback from professional was found to be a valuable tool to increase self-efficacy in patients [30].

Self-efficacy in patients seems to be connected to acceptance and control of their disease [17] and together with increased physical capacity it lets patients regain energy to enjoy and participate in (social) activities. Letting them feel like active players in their own CR process because of this increased competence in physical capabilities [8].

Stress

The second theme that was identified from the insights by the selected studies in this review is ‘Stress’. Next to the three basic psychological needs recommended by the Self-determination theory to create autonomous motivation [30], I also determined other themes in the reviewed literature that influence patient motivation during telerehabilitation. An often recurring theme is Stress. When only focusing on physical exercise as part of the TR program an important barrier that is stopping patients from internalizing autonomous motivation is overlooked [29]. This barrier is stress [29]. When psychological resources are spent trying to handle stress, there is no energy or motivation left to engage in the rehabilitation activities [29]. Therefore it is important TR programs incorporate a form of screening for psychological distress and offer patients the opportunity to discuss their worries with health care staff before becoming trapped in psychological distress [29].

Cardiac patients are physically but also mentally unstable immediately following heart surgery, in this first period of TR the use of the platform can become overwhelming, as some aspects require too much effort or commitment from the patient at this stage [10]. Also unclarity about their condition or the rehabilitation program in general can cause increased stress. Therefore it is important to enable patients to better comprehend their rehabilitation progress better [26], and should the platform communicate correct information regarding the condition of the patient. This can include online published pamphlets, a combination of text-based

information and features such as forums, as well as “ask an expert” services and more [2].

Autonomy

The theme ‘Autonomy’ (choice, volition and freedom) shows that health behavior goals of patients need to be in accordance with their own internal values and beliefs to be able to effectively stay motivated to work on living a healthier lifestyle.

Studies reporting barriers to motivation for lifestyle changes report that tailoring of interventions is important to sustain behavioral change [30]. Tailored content is in general perceived as more interesting, more relevant, and is remembered better compared to non-tailored material [2]. Motivational interviewing can be an interesting method to increase autonomy and stimulate overall motivation as it aims to specifically address, and hopefully change, the patient’s values regarding their rehabilitation goals [29].

This also complements the changing roles of the health care professionals and their patients. Through TR patients become more collaborators with the health care professionals rather than passive clients [9]. To gradually train patients towards self-management and better integration into their daily life they should be involved in the decision making. Giving patients the possibility to construct individually tailored activities and move about as desired is generally associated with a greater feeling of autonomy. This flexibility may also decrease the patients’ feeling of a barrier between being a patient and daily life [8]. As being able to integrate rehabilitation into everyday life also makes it easier to master the “task” of being a patient [8]. Allowing them to take into account “good days and bad days” [17] as well choosing activities especially suitable for their lifestyle [30]. For lifestyle changes and disease management to be successful the TR activities need to become a part of the patients everyday life [8].

Lastly the possibility for patients to be able to view their own data and progress seems to be appreciated as patients considered these graphs as motivational factors and learning opportunities [17]. Viewing one’s own progress also supports better self-awareness and promotes self-management [26].

Goals

The theme ‘Goals’ can almost partly be viewed as an extension of the theme ‘Autonomy’ because it plays of, of the ideas presented in ‘Autonomy’ that promote tailored goal setting and integration into daily life. For a goal to work motivational instead of limiting the patient needs to believe they are able to carry out the desired behavior change [30]. Personalized, small, and manageable tasks are positively received [10].

When it comes to maintaining goals several influences seem to play a role. Firstly remembering the goals, the possibility for patients to look back at their goal and receive tailored motivational messages on the platform or over text seem to have potential [17]. Also “rewarding” progress by making

this visible in the data summary encouraged patients to perform their CR activities more frequently and comprehensively [8]. Seeing accomplishment relates positive emotion to rehabilitation [10]. Furthermore routine seems to be important. It is more difficult for patients to start exercising again after periods of vacation or sickness [17]. Also pre scheduled exercise sessions, mobile text message reminders, and online follow-along or other gaming elements for exercise training during holidays can help to avoid relapses [17].

At the start of the CR process the increase in physical performance seems to be the biggest motivation to patients, however this physical capacity cannot be increased infinitely [17]. Therefore it is also important to support patients to keep setting new goals and maintain that “upward feeling” also after the completion of the TR program [17].

Relatedness

Lastly the theme ‘Relatedness’ (support by others) was identified from the insights by the selected studies in this review. Support is a very important aspect of CR for cardiac patients [10]. This support however can come from 3 different directions, namely: family and friends, fellow patients (peers), and health professionals. When it comes to family and friends, involvement of this group in the TR program of the patient seems to support the patients motivation [30]. For example training together or working as a team enabled the relatives to play a bigger part in the patients TR program, most patients name this “changing of behavior together” as a effective motivator during TR [10]. Involvement of people from the daily life of the patient leads to more person-centered care [2]. This including of maintaining social relations and other activities, like regular work, help integrating the TR activities into the patients daily life [8].

Peers play a different role in the CR process of the patient. Peers can provide a sense of belonging and recognition to a patient [8]. Seeing people similar to oneself succeed makes the patients believe that they too are able to eventually reach the desired goal [17]. An easy way for TR to support peer-modelling is through interactive interaction or gaming tools [17]. For example leaderboard scores were named as a positive way to comparing progress between patients, also reminders from other patients are more effective than system notifications [10].

Health care professionals take on a new role as coaches in the TR program, coaching patients in their return to everyday life [8]. The relationship between the professionals and the patients should involve surveillance in a supportive way [30]. The surveillance by professionals increases the attempt to fulfil goals in patients, and positive feedback on their progress provided patients with a feeling of achievement [30].

Lastly it is important to stimulate interactive relationships amongst the involved parties in the TR process and after [8]. Making it possible for the patient to continue receiving

quality support based on their progress from other healthcare providers after they are discharged from CR.

Semi-structured Interviews

The goal of the interviews was to confirm insights found in the narrative literature review, to elaborate on insights from the literature, and to bring in new insights into motivating cardiac patients during TR. In the following segment the Nurse specialist will be labeled as N1, the cardiologist in training as C1, the TR patients as P1-4. The quotes have been translated since there were originally in Dutch.

Competency

When speaking of competency (having the necessary knowledge and skills) both having the technical skills to use a TR platform and owning devices needed for the TR program come back as barriers of use. *"I don't own a laptop at home, will the hospital borrow me one for the TR program?"* (P1).

Because even though patients express a preference to video call over phone calls when speaking to healthcare professionals, learning how to make a video call needs to be addressed first. *"Doing a video call would be preferred! It is way nicer to be able to see someone's facial expressions. But I wouldn't know how to download such a thing on my laptop! So the healthcare professionals would have to teach me before TR starts"* (P3). This teaching is preferably done in person, possibly in combination with instructions to refer back to. *"Even if you provide click to click instruction, still some patients will feel too incompetent in their technical skills to do for example installations"* (C1).

"It works demotivating if the efforts to use the platform are too high" (N1). *"The use of the platform should feel natural and fit the worldview (belevingswereld) of the patient"* (C1). A second bottleneck for motivation in relation to competency is the patients confidence in their own physical abilities. *"I found it scary that the physical therapist could not see me, when doing the exercises I got prescribed. Am I doing them correctly? What if I am doing them wrong, will that have bad consequences? Someone saying, you're doing good, would have allowed me to feel more competent"* (P1). A similar notion is expressed by a second patient. *"I started my CR in the hospital, here I learned what my own boundaries are together with professionals. Once I could say for certain that as long as my heartbeat stayed below 120 nothing could go wrong I was never worried again. Also when exercising at home. It was nice to be able to find the barrier in a safe environment"* (P4). *"Lots of- and direct feedback helps to build that confidence in a patient their own capabilities"* (C1).

Stress

When it comes to stress it seems patients mostly have a need for information. *"When patients are in the hospital they are only paying attention to 2 things. 1 surviving and 2 getting to go home. But as soon they are back home they suddenly start to realize.. wow.. what did just happen to me? And*

that's when the many questions come" (N1) it seems to be necessary for the TR program to provide help in answering these questions. *"Through CR we as hospital staff try to create a safe place to answer these questions"* (N1). *"I had many questions during my TR program but I couldn't always ask them all during a phone call with the professionals. Often times right when I had hung up the phone I remembered another question I wanted to ask"* (P1).

Making stress and fear a discussable topic seems to be of value. *"Making fear discussable is difficult but important! The TR program should provide that safe space for patients to feel comfortable opening up to me"* (N1).

Autonomy

Both the patients and healthcare professionals notice the role of the hospital changing to 'coach' instead of 'a boss'. *"TR made me realize, I'm not doing these exercises to make my cardiologist happy. I'm doing them to improve my own life! The cardiologist looking at my data is only to give me tips a guide me along my way"* (P4). Motivational interviewing and other techniques used by the care professionals were thus shown to be appreciated. Also the integration into daily life was appreciated *"I get to choose myself when I want to do the exercises, and can always ask for more exercises if I want to change things up. This allows me to still partake in normal day to day activities at home as picking the grandkids up from school each day"* (P3).

As well as being able to choose in what specific TR activities the patient will partake. *"I wouldn't want to receive reminder notifications, let alone if they are messages from other patients instead of professionals. I just want to focus on my own process."* (P2). *"Getting messages from other patients would definitely motivate me! I would love to get more of a group feeling"* (P3).

Goals

The main service of goals for patients seems to have something they can hold on to. *"Sometimes I got stuck in these periods where I didn't know what I was doing anymore and what I was doing it for. But after a conversation with the case manager who reminded me of my goals and helped me get up I was ready to go again"* (P2). The platform making it possible to track the goals and their progress would be appreciated. *"I sometimes had difficulty remembering my goals, having an overview where I could look back on it would have been nice. Than I can also be reminded of how far I have already come"* (P2).

Lastly it is important for the patient to continue setting goals for themselves even after completion of the TR program. *"In the 12 weeks that someone is here we're starting something, but if the patient is unable to continue on their own they will fall back into their old damaging lifestyle. Here in the hospital we can't keep keeping track of patients after completion of their TR program. But it would be nice if their general practitioner could continue where we left off"* (N1).

Relatedness

“I’m very happy about my relationship with the healthcare professionals in the hospital during TR. They were my motivation to keep going when I needed it most. At the start of TR regular exercising was difficult to get into, but knowing that the professionals in the hospital were going to look at my data made me continue. Until eventually it just became part of my day to day routine and I didn’t struggle with it anymore!” (P4). This patient shares their positive experience with TR. All patients share that support from the hospital was very valuable to them. As well as support from family and friends. Only about support from/connection with peers the opinions varied. Where some were enthusiastic about getting in contact with peers others didn’t like that idea. “I’m younger than the average cardiac patient! I don’t need to hear all their grandkid stories. I’m only interested in contact with peers if its someone from a similar age and situation as me.” (P1).

Themes from analysis	Subthemes from analysis
Competency	Technical skills
	Learning
	Awareness
	Effort
	Physical exercise
Stress	Fear limiting behavior change
	Identify source of fear
	Unclarity
	Questions in relation to condition
	Timing
Autonomy	Respecting patients values and needs
	Self-management
	Decision making
	Integration into daily life
	Planning your own program
	Role care professionals
Goals	Formulating goals
	Maintaining goals
	Rewarding progress
	Evaluating goals
	Goals after completion program
Relatedness	Family/friends- Changing behavior together
	Family/friends - Involvement in TR
	Peers - Mirroring
	Peers - Belonging
	Care professionals – Coaching role
	Care professionals - Communication stakeholders

Table 1, Themes and subthemes formed by the combination of the information from the narrative review and the interviews

ITERATION ON GUIDELINES



Figure 2. Preliminary set of guideline cards

Based on the sub themes within the five overarching themes that came out of the results from the narrative literature review and the interviews I created a set of 10 preliminary guidelines. Two for each theme. I find it important the presented guidelines are considered usable by my target audience, designers. Therefore I put the formulation of the guidelines through one design iteration. To get input from my target group on the clarity and usability of the formulation of the guidelines before presenting my final guidelines, I used a questionnaire.

This method was chosen because it is one of the most practical ways to collect a relatively large set of input in a short amount of time. The questionnaire was relatively short and straightforward. Therefore it was expected that this would lower the threshold for participation. The questionnaire can be found in appendix C. And was shared amongst Industrial Design students at the Technical University of Eindhoven who have experience in design for cardiology, rehabilitation, and/or platform design through text messaging.

This questionnaire consisted of two parts. First participants were asked to imagine themselves in the scenario of being provided with the task to work on the following design challenge: "Design an online platform in the name of your local hospital to support a TR program that increases participant motivation in cardiac patients." Here the participants reviewed two selected guidelines on clarity and were asked to note where the presented guideline can be approved upon. After the participants had gotten an idea of what the guideline cards are and gotten a chance to think about what using them when working on a design challenge would be like, in the second part of the questionnaire more general questions about the guidelines were asked. Participants all gave consent for their input in the questionnaire to be anonymously used in this study to evaluate the preliminary set of guidelines.

15 designers with experience in design for cardiology, rehabilitation, and/or platform design responded.

Results

All participants stated that having the guidelines would change their way of tackling this design challenge. Explaining that the guidelines would steer their background research and help them with making decisions at the start the conceptualization phase. *"If I had the cards it would provide help in finding out what core aspects of the platform could be, and thus serve as a starting point for creating concepts around these guidelines."* *"I would start with brainstorming sooner and make a first prototype and/or show a more concrete plan to my users already at the start if the design phase."*

The main insights I took from the points of improvement on the clarity of the guidelines provided by the designers were about the size of the icon in relation to the text. *"Now the icon took most of the space on the card. But I think the words are actually more important. Maybe put some keywords in bigger size!"* The icon now takes up too much space on the card, while not really adding to the information that is communicated.

A second common suggestion that was made is the idea to include examples as well. On the card or in a separate booklet. *"This card is pretty much perfect. However, I would add suggested activities that help user achieve the goal of the card."*

The separation of the guidelines in groups within overarching themes however seemed to add to the usability of the cards. *"I think it is a very structured way of providing guidelines since I am now able to tackle the entire design challenge by going over each theme separately."* *"It would help sort out the different aspects of such a broad design task, so I think that they might help me sort some important things out in the beginning of my project."*

Cards as a medium are preferred for work in group and brainstorms however it is also agreed that future research should still look into other, maybe more suitable methods. *"For me design cards work pretty good. Future iterations might want to add something to it that stimulates the brainstorm around the cards, or examples on how to use the guideline in practice"*, *"Cards are perhaps the best way of communicating design guidelines. However, future studies should definitely still explore other options. Like the creation of videos to emotionally/mentally prime designers for each goal for example."*

In conclusion the overall response to the guidelines was positive. Especially towards clarity. *"The guidelines could give guidance and efficiency!"* *"I think the guidelines would help me greatly in structuring the project as each guideline can be covered one by one. This will instigate a time efficient process."* Future iterations should explore more about the amount of explanation that supports each guideline and the medium on which it is shared.

However for now it was a good confirmation I should continue to present the final guidelines structured in the five overarching themes.

DISCUSSION

For this research the following research question was formulated: "What are design guidelines that are interesting for telerehabilitation platform designer to use, that potentially help to motivate cardiac patients during telerehabilitation?"

The results suggest that design guidelines on how to potentially motivate cardiac patients during telerehabilitation can be divided in five different sections. As the areas 'competency', 'stress', 'autonomy', 'goals', and 'relatedness' all influence the motivation of a cardiac patient to participate in TR. Insight in these areas is important as it can help designers in making design decisions and improve cardiac care.

The created guidelines, that can be seen in Figure 3, based on sub themes within the five overarching themes (table 1) have potential in helping designers to create a motivational TR platform. As they show relevant information in this area in one place, information that is currently still limited and "scattered around". Many papers regarding TR seem to focus on only one or a few of the five themes. The guidelines can provide a clear overview of all five the areas that influence motivation while still making it possible for a designer or researcher to quickly find relevant information when only interested in one of the five themes.

However the guidelines and the research to support them still have limitations. Because of time constraints there has been chosen to do a narrative literature review. If more time would have been at hand a systematic literature reviews could have possibly provide more insights, making it possible some insights have been overlooked. Also the low participant number in the interviews, as well as the participants being reached through convenient sampling could have led to bias. The evaluation of the guidelines on clarity done in this project through the questionnaire is of an exploratory nature, and thus the results should be viewed as such. Lastly this study was conducted during the Covid-19 pandemic. To adhere to the restrictions and guidelines, the entire study with the exception of one interview was conducted online. Communication with participants and experts happened through email, video calls in Teams and over the phone. Therefore the interview results with the patients currently in their TR process might not provide a representative insight into a TR process in the normal situation.

The set of guidelines presented in Figure 3 at the moment can still be improved and expanded upon, in future iterations. However I do believe that the guidelines presented in this paper from a strong base.

Future work should focus on usability of the guidelines for its target audience, designers. As this research mostly focused on collecting information regarding motivation

during TR, also a first step in evaluation the guidelines has been done. When expanding this evaluation I expect even more interesting and valid usability improvements can be found.

Lastly when looking at the healthcare sector as a whole, I think TR offers possibilities for future work that go beyond the CR that is discussed in this paper. Especially when it comes to aspects like integrating the rehabilitation process into the daily life of the patient. But if the guidelines proposed in this paper really can potentially assist designers, when designing TR platforms in other areas of health care where patients need to deal with chronic diseases or disabilities, needs to be researched.

CONCLUSION

In this research five themes were defined that show to have influence on motivation of cardiac patients to participate in a TR program: Competency (sufficient knowledge and skills); Stress; Autonomy; Goals; and Relatedness (support by other humans).

Within each of these five overarching themes, four subthemes were defined. On which the presented guidelines are based.

These five themes and their sub themes are based on the results from a narrative literature review and 6 semi-structured interviews with different stakeholders in a cardiac TR process. Each theme gives insight into values and elements related to the motivation of cardiac patients during TR. Therefore these five aspects are recommended to be

taken into account by designers when working on a TR platform that should motivate cardiac patients to participate. Insight in this is important as it can help designers in making design decisions and improve cardiac care.

Furthermore, this research is a step forward to showcase the possibilities TR has to offer that can complement centre-based CR. Showing it is possible to create a CR program suitable for each cardiac patient and through a sufficient level of motivation achieve this substantial survival benefit, reachable through CR, for more cardiac patients worldwide.

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