UNIVERSITY OF TWENTE.

Health Psychology & Technology

Adherence, experiences and attitudes of patients included in an early e-health cardiac rehabilitation program

Master assignment
Enschede, 22-05-2018

C. Spenkelink
Master Health Psychology & Technology
Faculty of Behavioural, Management and Social Sciences
University of Twente

Dr. E. Taal (first supervisor)
Dr. P. ten Klooster (second supervisor)
Dr. M. Veehof (external supervisor)

Abstract

Background: Medisch Spectrum Twente (MST), in collaboration with Roessingh Research Development (RRD) developed a home-based e-health early cardiac rehabilitation program by means of a web-based portal for patients who underwent Coronary Artery Bypass Grafting (CABG) or heart valve surgery. Exercises are a central element of this program, patients have to perform tailored exercises at home three times a week. However, people who do participate in cardiac rehabilitation programs tend to have poor adherence to these programs. It is shown that adherence to home-based programs is better than adherence to centre-based programs, but nevertheless still suboptimal. Moreover, adherence to e-health interventions varies widely. The wide variation of adherence to e-health programs as well as the suboptimal adherence to cardiac rehabilitation programs indicates the need to better understand the adherence behaviour of patients who participate in web-based cardiac rehabilitation programs. Multiple theoretical models are developed to explain individual's adherence behaviour. One of these models is the Theory of Planned Behaviour (TPB). Based on the TPB, the Technology Acceptance Model (TAM) has been developed to predict and explain the use of a technology. In this study, these models will be used to explain the adherence behaviour to the online program.
Method: This study contains a mixed methods design. A log data analysis was conducted among all users of the intervention. Semi-structured in-depth interviews were conducted in a sub sample of participants after they had completed the online exercise program.
Results: The adherence of the 37 participants ranged from 0% to 100%, the mean adherence was 63% and participants were generally satisfied with the online program. The results of this study showed that participants got motivated to be physically active by means of the online program, the program offers them trust in what they were allowed to do, and they indicated that they gained better health outcomes by means of the online program. However, there were also participants who found it a disadvantage that they could not practice at non-training days. Another disadvantage was that participants experienced problems with the pedometer. Besides, participants perceived it as unclear if their messages were read and they indicated that it took a long time for receiving an answer from the health professional or they did not receive an answer on a message. Further, participants indicated a couple of improvements to improve the online program, for example, making some options more visible, presenting participants' progression, giving reminders to wear the pedometer and therapists should respond more quickly to messages.
Conclusion: In general, participants were satisfied with the online program. The most important finding was that the online program offered participants trust in that they knew what they were allowed to do by means of the program. Another important finding was that the program was experienced as a support to be physically active. Participants were motivated to do the exercises and most of them did not need motivation of their social network. Besides, the feedback of the health professional works probably motivating and is also very important for participants, because they valued the support of the health professional and this also gave them trust. A disadvantage was that there were few persuasive features added in the program. Adding persuasive features, such as reminders, self-monitoring and rewards could stimulate and motivate the use of the program even more.

Keywords: early cardiac rehabilitation, exercise-based, e-health, adherence.

Content

1. Introduction

Cardiovascular disease is the most common cause of mortality globally, with 17.7 million deaths in 2015, accounting for one-third of all global deaths. Of these deaths, 7.4 million people died due to coronary heart disease (CHD) (WHO, 2017). CHD involves stenosis of the coronary arteries which limits the transport of oxygen-rich blood to the heart. Although the mortality rate has decreased in the recent decades, the morbidity rate from CHD has increased due to improved treatments and diagnoses (Dalal, Zawada, Jolly, Moxham and Taylor, 2010).

There are different treatments for CHD. One of the treatments is heart valve repair or replacement, this could be done by means of small incisions, but it could also be an open-heart surgery. The most common type of open-heart surgery is Coronary Artery Bypass Grafting (CABG), which improves blood flow to the heart (NIH, 2013).

After open-heart surgery, cardiac rehabilitation is offered to patients. Cardiac rehabilitation is important in heart disease care and is proposed for people after cardiac events to improve recovery and prevent further development of cardiac illness (Dalal et al., 2010). Cardiac rehabilitation programs consist of education, exercise, changing behaviour and psychological support strategies aimed at targeting traditional risk factors for cardiovascular disease (Dalal et al., 2010).

A core element of cardiac rehabilitation programs is exercise therapy. Anderson et al. (2016) conducted a systematic review and meta-analysis, which included 63 randomised controlled trials and have shown that exercise-based cardiac rehabilitation reduces cardiovascular mortality and the risk of hospital admissions and improves health-related quality of life compared with usual care among patients with CHD.

Cardiac rehabilitation programs are usually centre-based programs. However, a number of disadvantages of centre-based programs have become apparent, like problems with accessibility and parking at the local hospital, dislike of groups and interference with work or domestic commitments. This could result in patients dropping out of cardiac rehabilitation programs. Home-based rehabilitation programs can remedy these disadvantages and might be more convenient for patients (Dalal et al., 2010). A systematic review and meta-analysis of Jolly et al. (2006), which included 6 randomised controlled trials, and Dalal et al. (2010), which included 12 randomised controlled trials (incl. the 6 trials of Jolly et al.) have shown that home-based cardiac rehabilitation programmes have the same benefits on exercise capacity, modifiable risk factors, health related quality of life, and cardiac events compared to centre-based programmes.

Patients who undergo CABG or heart valve surgery have a wait time for an exercise-based rehabilitation program of approximately six weeks after surgery. These six weeks are related to the healing of the sternum (Dafoe, Arthur and Strokes, 2006). According to Dubach, Myers and Wagner (1998) rehabilitation after cardiac surgery can start as early as one week after surgery without having a negative influence on infections, mortality or readmission. Moreover, when cardiac rehabilitation starts earlier, outcomes, like mortality, cardiovascular

events, functioning, cardiorespiratory measures, quality of life, cardiac functioning and exercise capacity can be positively influenced (Fell, Dale and Doherty, 2016).

Because of the wait time for cardiac rehabilitation after open-heart surgery or valve surgery, Medisch Spectrum Twente (MST), in collaboration with Roessingh Research Development (RRD) developed a home-based e-health early cardiac rehabilitation program by means of a web-based portal. E-health is the use of information and communication technologies for health (WHO, n.d.). The home-based e-health early cardiac rehabilitation program starts the first Friday after discharge from the hospital. Exercises are a central element of this program, patients have to perform tailored exercises at home three times a week. The effectiveness of this program is currently evaluated, expected is a better physical condition and better health outcomes for patients.

Daly et al. (2002) have shown that those who do participate in cardiac rehabilitation programs tend to have poor adherence to these programs. A couple of factors are related to poor adherence which include being female, being older, having a lower education status, having poor functional capacity and the strength of the physician's referral. According to Dalal, Doherty and Taylor (2015), poor adherence is influenced by factors such as geographical location, access to transport, and a dislike of group based rehabilitation sessions. Dalal et al. (2010) have shown that adherence to home-based programs is better than adherence to centre-based programs, but nevertheless still suboptimal.

Currently, there are a lot of cardiac rehabilitation programs, but only a few of them are home-based e-health programs specifically for patients who underwent open-heart surgery. There is a limited availability of studies about home-based e-health cardiac rehabilitation, and these studies show a wide variation in the content of interventions. Moreover, there were different ways of measuring adherence. In addition, Mohr et al. (2011) have shown that adherence to e-health interventions varies widely. Adherence in this context is defined as the use of e-health interventions over time, measured by number of logins, time on site, number of modules completed, and number of characters typed into the site (Free et al, 2013). Eysenbach (2005) has shown that adherence to e-health interventions is generally low. Additionally, Kelders, Kok, Ossebaard and Gemert-Pijnen (2012) conducted a systematic review, which included 83 web-based interventions, and have shown an average of 50% of participants that adhere to web-based interventions, which confirms that non-adherence is an issue in web-based interventions.

Multiple theoretical models are developed to explain an individual's adherence behaviour. One of these models is the Theory of Planned Behaviour (TPB) of Ajzen (1991). The TPB explains behaviour by identifying relations between the components attitudes, subjective norms, perceived behavioural control, intentions and behaviour (figure 1). This model will be used to explain the adherence behaviour to the online program.

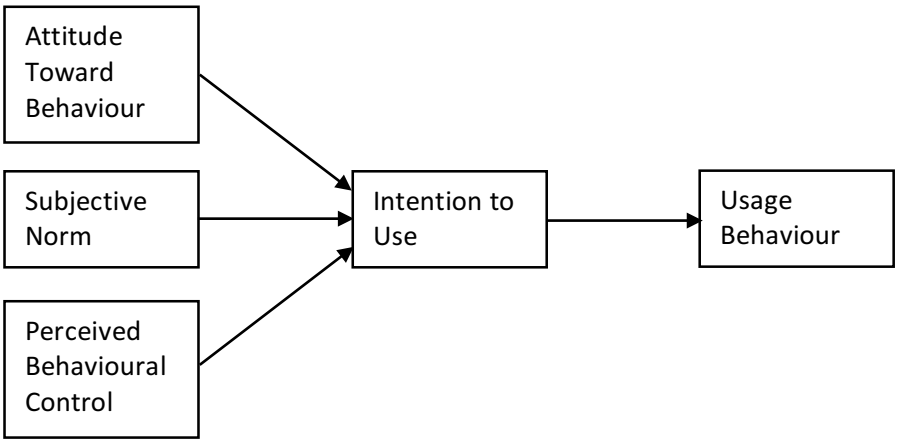

Figure 1
Theory of Planned Behaviour (Ajzen, 1991)

Attitude toward behaviour is defined as the degree to which a person has a (un)favourable evaluation or appraisal of the behaviour in question. According to the TPB, attitude toward behaviour, together with subjective norm and perceived behavioural control, directly influence the intention to use (Ajzen, 1991). Subjective norm is considered as a very important antecedence to the behaviour (Ajzen, 1991). Subjective norm refers to the degree to which an individual believes that others who are important to the person think the person should perform a certain behaviour (Gong and Yan, 2004). Perceived behavioural control is compatible with the concept self-efficacy, and can be explained as an individual's estimate of his or her own capability to use the program. Behaviour of individuals is strongly influenced by their confidence in their ability to perform it. Perceived behavioural control, together with intention, can be used directly to predict behavioural achievement (Ajzen, 1991).

The intention to perform a behaviour, is a central factor in the TPB. According to this theory, intentions are assumed to capture the motivational factors that influence a behaviour. For example, how hard people are willing to try or how much of an effort they are planning to exert, in order to perform the behaviour. The stronger the intention to engage in a behaviour, the more likely should be its performance. Intentions would be expected to influence performance to the extent that the person has behavioural control, and performance should increase with behavioural control to the extent that the person is motivated to try (Ajzen, 1991).

Based on the TPB, a specific theoretical model is developed to predict and explain the use of a technology: the Technology Acceptance Model (TAM) of Davis (1989) (figure 2).

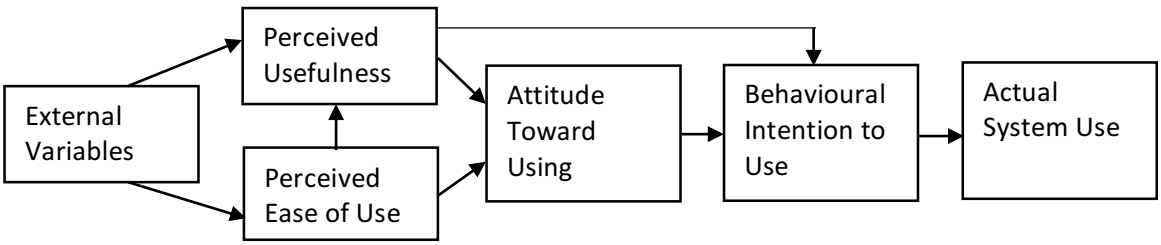

Figure 2
Technology Acceptance Model (Davis, 1989)

The TAM has been successfully applied to investigate users' intention to use a technology system and adoption decisions across various contexts and user populations. This model focusses on two theoretical constructs, perceived usefulness and perceived ease of use. These two constructs are the fundamental determinants of system use. The perceived usefulness and the perceived ease of use are in turn determined by external variables, such as situational involvement, prior use and computing support (Lee et al, 2011). Besides the TPB, TAM will also be used to explain the adherence behaviour to the online program.

The first determinant of TAM is perceived usefulness, which is described by Davis (1989) as the degree to which a person believes that using a particular system will improve their health. People tend to use or not use the program to the extent they believe it will help them improve their health. Perceived usefulness is a good predictor of the individual's acceptance of the program, it directly affects users' behavioural intention to use it. Further, perceived usefulness reflects the users' subjective probability that using the program will have a positive effect on personal wellbeing (Lee et al., 2011).

The second determinant is perceived ease of use. This is described by Davis (1989) as the degree to which a person believes that using a particular system will be free of effort. Perceived ease of use would affect the intention to accept the program indirectly through the perceived usefulness (Lee et al., 2011). The easier the program is to use, the more useful it can be perceived (Gong and Yan, 2004).

Both perceived usefulness and perceived ease of use influence attitude toward using the technology. Attitude refers to the degree to which an individual perceived a positive or negative feeling related to the technology. The attitude toward the program, combined with perceived ease of use and perceived usefulness would affect the actual technology use and the duration of use in a given setting. In both TAM and TPB, attitude has a direct influence on the intention to use the program. According to the TAM, the attitude toward the program is the strongest predictor of the behavioural intention to use the program. The behavioural intention to use the program is jointly determined by an individuals' attitude regarding the use of the program and its perceived usefulness (Lee et al., 2011).

The TAM and TPB give insight in the possible determinants (attitudes, subjective norm, self-efficacy, ease of use, usefulness) of adherence; but not in how these determinants and actual adherence can be improved by technology. Therefore, the Persuasive System Design (PSD) model of Oinas-Kukkonen and Harjumaa (2008) can be used. Actual usage of the program can be influenced by persuasive elements of the specific program which can stimulate and motivate participants to use the e-health technology. 'If a system is useless or difficult to use, it is unlikely that it could be very persuasive' (Oinas-Kukkonen and Harjumaa, 2009). Oinas-Kukkonen and Harjumaa (2008) described persuasive systems as 'computerized software or information systems designed to reinforce, change or shape attitudes or behaviours or both without using coercion or deception'. There are various persuasive system principles, Oinas-Kukkonen and Harjumaa described primary task support, dialogue support, system credibility support and social support (Appendix A).

Primary task support concerns the degree in which the technology offers adequate support in carrying out the participant's primary task. According to Kelders et al. (2012), primary task

support elements are most used in interventions. Tailoring is an example of a primary task support, and is an important principle of effective health communication. According to Mohr et al. (2011) treatment plans can be tailored to focus on the individual needs, which is likely to influence adherence to the treatment.

In dialogue support, certain principles are described about how to implement computer-human dialogue support in a manner that helps the participant to keep moving towards their goal or target behaviour. In dialogue support, reminders are the most frequently used principles. Reminders are important in increasing adherence and the effectiveness of web-based interventions. However, praise and rewards are less employed, and this can be seen as a shortcoming (Kelders et al., 2012). In studies about serious gaming and gamification, praise and rewards were found to have positive effects on the results of interventions.

System credibility support describes how to create a system so that it is more credible and thus more persuasive. An example of this design principle is trustworthiness: the system should provide information that is truthful, fair and unbiased.

Finally, social support, this category describes how to design the program so that it motivates users by leveraging social influence (Oinas-Kukkonen and Harjumaa, 2009). Social facilitation is the most often used principle in the social support category. Social facilitation is described as providing the opportunity to contact other users of the intervention (Kelders et al., 2012). Mohr et al. (2011) confirmed that human support features intend to increase adherence behaviour. Besides, the therapeutic relationship is an important predictor of outcome in distance treatments. It potentially influences adherence to e-health interventions. The emotional attachment captured by the idea of bond likely enhances the effects of accountability of being adherent to the program (Mohr et al., 2011).

Research purpose

The wide variation of adherence to e-health programs as well as the suboptimal adherence to cardiac rehabilitation programs indicates the need to better understand the adherence behaviour of patients who participate in web-based cardiac rehabilitation programs.

At the Medisch Spectrum Twente hospital an early e-health cardiac rehabilitation program is developed and its effectiveness is currently under evaluation. It is important to gain a broader insight in the adherence to this program and the experiences of participants, to improve the adherence to this program. This study contains a mixed methods design and is aimed at gaining insight in the adherence with prescribed exercises, experiences and attitudes of the participants who used the intervention regarding the online practice program. Based on these insights, recommendations will be given to improve the effect of future e-health interventions and the adherence to these interventions.

The aim of this study

To evaluate the adherence with prescribed exercises, experiences and attitudes of patients included in the early e-health cardiac rehabilitation program.

Sub questions
What was the adherence with prescribed exercises of patients included in the early e-health cardiac rehabilitation program?

What are the determinants of adherence of patients included in the early e-health cardiac rehabilitation program based on the TPB and TAM (usefulness, ease of use, attitude, subjective norm and perceived behavioural control)?

How can adherence to the early e-health cardiac rehabilitation program be improved according to patients?

2. Methods

2.1 Study design
This study contained a mixed methods design, which is a design in which both quantitative and qualitative data are integrated in the same study (Clark and Creswell, 2007). A log data analysis was conducted among all users of the intervention. Semi-structured in-depth interviews were conducted in a sub sample of participants after they had completed the online exercise program.

2.2 Online exercise program
The e-health exercise program was developed for patients with several diagnoses, for example COPD (Dekker-van Weering, Vollenbroek-Hutten and Hermens, 2016). In this study, the program was adapted to the needs of participants in cardiac rehabilitation. The program exists of three different modules: online exercising, telemonitoring and telecommunication.

<u>Online exercising</u>
The online exercising module aims to support the participant in his/her reconditioning at home. The database of this module consists of 60 different exercises. These exercises include a video with an explanation of the exercise and written description on how to perform the exercise. There are five main categories for the exercises: strength, thoracic mobility, breathing, relaxation and balance. The last two categories are only offered on indication. Patients are asked to perform the exercises three times a week, on Monday, Wednesday and Friday. Once per week the exercises are selected by the physiotherapist based on a training schedule. Besides the online exercises, a tailored walking goal is shown in the program and patients are recommended to achieve their walking goal every day. The exercises are tailored to the needs of patients and their rehabilitation progress, which means that the exercises fit in the patient profile (relaxation, balance and stairs exercises) and the level of intensity, balance exercises and walking goal are in line with the performance of the patients.

<u>Telemonitoring</u>
The progress or deterioration in health of the patient are monitored. Different standardized questions are asked at fixed time intervals, for example the Borg scale of perceived exertion, with the aim to gain insight into the rehabilitation progress of the patient. The answers to

these questions are presented in an overview which shows the health status of the patient. Additionally, it gives insights in the adherence of the patient by means of a bar graph.

Telecommunication
Patients are explained that they have the option to use telecommunication. Telecommunication makes it possible for the patient and professional to communicate with each other. There are two options for sending a message: messages linked to exercises or general messages. A message to a specific exercise can be used, for example, to specify if the exercise was too difficult or if it went fine. Or it can provide supplementary explanation on how to perform the exercise. When patients or physiotherapists received a message, a notification is shown in the program, both physiotherapist and patient can respond to questions from each other. General messages are not linked to specific exercises. There are direct messages between the physiotherapist and the patient. For example, messages about the rehabilitation progress or patients functioning.

2.3 Study population and procedure
Participants were patients of an evaluation study (trial ID NTR6274). A total of 207 patients were asked to participate in the trial. First, 76 patients were asked to participate in the control group and 45 of them actual participated. Subsequently, 131 patients were asked to participate in the experimental group and 45 of them actual participated in the experimental group of the trial. For this study, patients were selected from the experimental group of the trial. The trial was meant for patients who underwent an open heart surgery, for example CABG or valve surgery. Patients could only participate the trial if they met the following criteria:

- No major complication after surgery;
- Clinically stable and able to perform the exercise program;
- Attending cardiac rehabilitation;
- Access to the internet;
- Control Dutch in writing and reading;
- Age>18;
- Reside in adherence area of the MST.

After completion of the online program, participants were divided into tertiles based on their adherence: low-adherent, moderate-adherent or high-adherent. Initially, fifteen participants received a letter with information about the additional interviews and informed consent. The most recent users were invited first. One week after sending the letter, the researcher contacted the users by telephone and asked if they wanted to participate in the interview. If they wanted to participate, an appointment was made for completing the interview. The aim was to interview five participants per adherence category. The first five participants of each group received a letter. When they indicated that they did not want to participate the interview, a new letter was sent to the following participant of that specific group. These invitations kept going until five participants per group wanted to participate in the interview. During the appointment, the completed informed consent was gained (see appendix B). The interviewer orally explained the content of the study whereby explicitly was mentioned that the provided information would be processed confidentially and anonymously. Patients were interviewed for about 45 minutes and the interviews took place

at a date, time and location of the patients' preferences. The interviews were audiotaped. Participants could receive reimbursement of travel expenses when necessary.

2.4 Interview

The patients were told that the purpose was to understand their experiences and attitudes regarding the online practice program. Subsequently, the interviewer asked semi-structured questions and went in-depth by means of supplementary questions. The interview questions are shown in Appendix C. First, the questions were about an overall evaluation of the program; the experiences, attitudes and satisfaction with the online program. Subsequently, the interviewer audited together with the participant the different modules (training module, step goal, message or contact module, supporting videos in every activities and information module) of the online program and asked if they used the specific module. Further, the interviewer asked (in-depth) questions to gain insight in the experiences and attitudes about each specific module. Besides, the interviewer asked for tips to improve the module or overall program.

2.5 Data analysis

A log data analysis was conducted among all users (n=37) of the online practice program to gain insight in the objective data regarding the adherence with the prescribed exercises. The adherence to the online exercises was measured by calculating the percentage adherence to these exercises, which is expressed as the percentage of performed exercises versus prescribed exercises. An exercise was noted as performed when participants clicked the button 'exercise performed' after completing the exercise.

An approach was used that combines deductive and inductive elements of analysis. This approach is similar to the framework approach (Pope, Ziebland and Mays, 2000). The interviews were audiotaped and then fully transcribed. After transcription, the audiotapes were deleted. The transcriptions were analysed in Atlas.ti, in order to be able to discover patterns and to cluster the data. In the first stage, the transcriptions were analysed line by line, and relevant citations were assigned conceptual labels. The next stage involved the search for relationships between conceptual labels and the following topics based on the Technology Acceptance Model (TAM) and the Theory of Planned Behaviour (TPB): ease of use, usefulness, attitude, subjective norm and perceived behavioural control. Labels which could not be placed under one of the subjects based on TAM or TBP were placed under 'other'. The goal was to develop and relate categories. In the final stage, categories were integrated and refined. In each stage, ambiguities were resolved in discussion with two other researchers.

3. Results

3.1 Adherence with prescribed exercises

A total of 45 patients participated in the online program. Seven patients did not start with the program, which means that 38 patients completed the study. One patient was excluded because this person did not undergo an open-heart surgery. The adherence of the 37 participants ranged from 0% to 100% and the mean adherence was 63%. Based on the adherence distribution, tertiles of adherence were made. Table 1 presents an overview of the three groups.

Table 1

Adherence[1] distribution in groups

	Low (n=13)	**Moderate** (n=11)	**High** (n=13)
Mean percentage (st.dev.)	28 (22)	72 (6)	91 (6)
Minimum	0	63	83
Maximum	58	80	100

[1]*Adherence is defined as the percentage of performed exercises of the number of prescribed exercises*

3.2 Interviews

The aim was to interview five participants per group. Eighteen participants were approached for an interview, four of them did not want to participate because of the following reasons: two of them had physical complaints, one person saw no reason to participate in the interview and one person was not reachable by phone. An overview of the characteristics of participants of the interviews is presented in table 2.

Table 2

Characteristics of participants of interviews

Respondent	**Gender**	**Age**	**Adherence**	**Satisfaction**
i16	Male	62	80%	8
i23	Male	71	71%	7,5
i26	Male	76	63%	6
i28	Male	74	100%	8
i29	Female	70	100%	8
i31	Male	73	79%	9
i32	Male	72	89%	8,5
i34	Male	67	6%	7
i36	Male	74	92%	8
i37	Male	78	76%	8
i39	Female	46	58%	8
i41	Male	60	44%	7,5
i42	Male	68	91%	8,5
i43	Female	74	26%	10

The experiences and attitudes of participants about the online program are presented in the next paragraphs. Each paragraph is about a certain module of the online program. The first paragraph is about the overall evaluation of the program, subsequently the training module, the step goal and the pedometer, the message or contact module, the module with the supporting videos in everyday activities and the information module. The experiences and attitudes were divided into different determinants based on TPB and TAM: ease of use, usefulness, attitude, subjective norm, perceived behavioural control. Experiences and comments which could not be placed under one of the determinants based on TPB or TAM were placed under 'other'. Besides, participants indicated improvements for the online program. These improvements are presented in the last paragraph of this chapter.

3.2.1 Overall evaluation of the program

This paragraph is about the overall evaluation of the program. First, participants were asked to give their satisfaction with the online program a grade from 0 till 10. The grades varied between 6 and 10 (see table 2), with a mean of 8 and a median of 8. In general, participants were satisfied with the online program. Their overall experiences and attitudes are presented in this paragraph based on the determinants: ease of use, usefulness, attitude, subjective norm, perceived behavioural control, and 'other'.

Ease of use

About half of the participants (n=6) found the program easy to use, they found it simple and clear. Ten participants were pleased that it was a home-based program, because they did not have to travel to an external location (n=8), preferred to train alone instead of training with others (n=1), and some found it pleasant that they were able to train at other locations than their home (n=3), for example when they were on vacation. However, three participants did not experience it as pleasant that it was a home-based program, because they perceived no encouragement in this way (n=2), no social contact and not the right equipment (n=1), for example to count calories.

Ri37: 'Besides the water bottles, I have no equipment at home. The bicycle at the gym has an option to count calories or to change the power. I do not have that kind of options at home.

Usefulness

Several participants (n=4) mentioned that the program was a support to start exercising and to move forward (n=4). Other participants did not mention this spontaneously.

Ri16: 'I think it is a great support to move forward'.

However, one participant did not know if the program was useful.

Ri26: 'I don't know if I benefited from it'.

Further, one participant did not find it useful to do the exercises when a lot of other physical activities were done, and did not log in to the program on these days.

Attitude

Most participants (n=10) had a positive attitude towards the program. They experienced it as a good, enjoyable and great program, and it was not experienced as a punishment to use the program.

Ri37: 'Every time when it was a training day, I thought: I will do this with pleasure. I did not find it a punishment, I liked it'.

Subjective norm

Half of the participants (n=7) indicated that their social network had a positive attitude towards the program. Their social network considered the program as wonderful, good, important, positive and normal.

Ri16: 'Actually in my family they said: that is actually more or less normal. They are like: come on, we have to do this. They all thought it was wonderful, especially the explanation of what you could do from the beginning.'

One participant did not know which attitude the social network had towards the online program.

Ri31: 'I did not get a reaction from them. I think that they perceived it as normal.'

Perceived behavioural control

Three participants thought that they had sufficient computer skills. Most participants (n=10) said that they had no problems with logging in to the program. However, there were also problems with logging in to the program (n=3). Two of them found it difficult to open a website. Once one of them was on the website it was easy to log in, the other participant had difficulties in working with the computer. One participant told that logging in to the program had failed multiple times because of unfamiliarity with using computers. Of the three participants who experienced problems with logging in, two participants mentioned that they found it difficult to use a computer in general.

Other

There were also other reasons why participants did not log in to the program. One participant forgot to log in, two participants did not log in because they were suffering from flu and three participants mentioned that they did not log in because of other activities.

In summary, most participants were pleased that is was a home-based program, however some participants were not. Logging in was experienced as easy according to most participants, although some participants experienced problems with it. Reasons why participants did not log in were: flu, other activities or they forgot it. Participants and also their social network had often a positive attitude about the program. One participant did not know if the program was useful, but other participants experienced it as a support to start exercising and to move forward. A central module of the program was the training module. In the next paragraph the attitudes and experiences about the training module are presented.

3.2.2 Training module

In the training module, participants received their prescribed exercises. The experiences with respect to this module are presented based on the determinants: ease of use, usefulness, attitude, subjective norm, perceived behavioural control, and 'other'.

Ease of use

According to three participants, the training module was well constructed. One participant said *'you just have to click on the button 'training' and the rest followed automatically'* (Ri32). Another participant did not encounter any problems and one participant said: '*I find it easy to use*' (Ri39). However, one participant perceived it as unclear how to proceed when the exercise was done. It was unclear that 'exercise performed' was a button that had to be clicked. Besides, the option to send a message to the physiotherapist was not noticed by two participants: *'I have not seen it at all'* (Ri26). Other participants said nothing spontaneously about this subject in general.

Almost all participants (n=13) found the video about the exercises clarifying. Because of the video, they knew how to do the exercises and the corresponding body pose (n=10), and for three of them just the video was good enough to do the exercises. Further, four participants said that the text about the exercise was clear. The combination of the text and the video was pleasant for five participants. However, four participants indicated that the text about the exercises was unclear. For instance, one participant said that it was unclear what was mentioned under 'number of repetitions'.

Ri31: 'In another exercise it was described differently, repeat it 3 times. For a certain exercise you have to do it 10 times or something, I cannot remember it exactly anymore, but I thought do I have to do it 30 times or 90 times. That's what I mean'.

Another participant found the text open for multiple interpretations. One participant said that there was a strange formulation in one of the texts and one participant was unable to translate the text into an exercise.

Participants (n=6) found it a disadvantage that they could not practice at non-training days.

Ri39: 'Then I was too late. I have stopped the training once, I thought I would finish it later, but that wasn't possible'.

Further, two participants considered it as a disadvantage that there was no time planning presented at the exercises. Both participants found it disappointing that it was not mentioned in which time frame the exercises had to be completed, they missed information on how long they had to rest between (repeating of) exercises. And one of them told that he missed a specific timing of the exercise.

Ri42: 'There should also have been a time, like 10 or 15 seconds, and that you have to measure it with a clock or watch. Hold on for 15 seconds and release for 10 seconds. That is not mentioned'.

Two participants told that on a certain moment there was no training prescribed and they could not practice.

Ri31: 'I have logged in at al prescribed days, but once there was no program. I think they forgot to prescribe a program, I called you about that'.

<u>Usefulness</u>

Regarding the positive effects, participants (n=8) thought that they improved their physical condition by doing the exercises. Two participants indicated that they were able to better walk the stairs because of the program.

Ri36: 'For example, I was able to better walk the stairs. In regular day to day practice I won't do that kind of repetitions as in this exercise.

Further, participants (n=4) experienced positive effects on their muscles, one of them said:

Ri41: 'By means of the exercises I got more strength in my legs, so that I could stand up without using your arms'.

An improved mobility was experienced by one participant. This person said that this had benefits for the social life. Further, the program was good for mental health (n=2), both participants became calmer by doing the exercises.

Ri23: 'It was very good for my state of mind, I became somewhat calmer'.

Almost all participants (n=12) said that the program offered them trust in what they could do.

Ri16: 'It was a good support for me to do something, but also to know what I'm allowed to do. Otherwise it would have become a very big question of what I am allowed to do and what not'.

One participant did not understand the usefulness of one exercise, the 'bridge' exercise. This exercise was experienced as a torture and the participant could not imagine that other persons who also had an open-heart surgery could perform this exercise at this stage.

Attitude

Almost all participants (n=13) were motivated by the program to be more physically active. However, two participants were not motivated by the program to perform exercises, they missed a kind of support in the program.

Ri26: 'In my view, it is. And that is because… maybe because there is no encouragement. Maybe I was too lazy for that or something'.

The exercises were independent of time and most of the participants (n=12) were pleased that they could do the exercises whenever they want.

Ri16: 'It gives you freedom, I think it is important. […] I found it nice, today I had to do the exercises, but in the morning, I had to do something else, so I will go practicing this afternoon'.

However, because of the independence of time for the exercises, some participants' (n=2) missed an encouragement. They both said that it led to procrastination.

A good variety of the exercises was experienced (n=5), different muscle groups were trained with the exercises. Also, the structure of the exercises was experienced as pleasant (n=6).

Ri36: 'In the beginning the exercises were easier and gradually they were heavier'.

- *'What did you think of that'?*

'Good'.

Two participants experienced a relaxation exercise as an unpleasant exercise.

Ri28: 'I didn't see the added value of the relaxation exercise. For me these exercises are not tangible enough, too woolly.'

The exercises were experienced as easy (n=6).

Ri28: 'In general, the exercises feel like fairly light to me.

Nevertheless, two participants experienced a couple of exercises as hard, but they both said that they 'just did it', even when the exercises were hard.

Ri39: 'I have not done anything for a while, I must also start practicing again. So, just do it'.

Further, one participant found it disappointing that the progression was not mentioned.

Ri34: 'At the fit-training they noticed the progression, but I couldn't see my progression in the online program.

- *Did you miss that in the online program?*

Yes, I did. I missed a kind of feedback about how well I performed the exercises.'

Subjective norm

Participants (n=9) said that they trusted the expertise of the professionals who prescribed the trainings. They thought that the training was set up with medical knowledge.

Ri37: 'I liked it that I followed a program where everything… I assume by experts, so you don't do wrong things'.

Ri42: 'I had the feeling that it were professionals that designed the program, which gave me the feeling I would benefit of the exercises.

One participant said that the program gave trust for the social network, they could see what the person was allowed to do.

Further, participants (n=4) explicitly got motivated by their social network to do the exercises.

Ri34: 'They said: 'that is very good, you have to do that', and they have more experiences with people with heart diseases'.

However, eight participants did not get motivated by their social network. Most of them did not need motivation because they thought it was very important and were sufficiently motivated by their own.

- *'Your wife found it important. Did that motivate you?'*

Ri37: 'No, I found it important by my own.'

- *And what about the opinion of your social network?*

Ri37: 'That did not motivate me, because I had to do it for myself.'

Perceived behavioural control

One participant performed exercises without using the online program, this person forgot to start the program and did exercises he remembered from previous trainings. There were also participants (n=3) who performed additional exercises on non-training days, one of them performed the favourite exercises again and one did only the easy exercises again. Two participants experienced certain exercises as too hard and they skipped these exercises, for both participants it was about ground exercises. One of them could not stand up after the exercise and the other participant had too much pain during the exercise and experienced it as a torture.

One participant expected beforehand to be physically able to do the exercises, but experienced the exercises as much harder than expected. Other participants (n=2) thought that their body was not able to do a certain exercise. For both participants, it included ground exercises.

Ri26: 'There were exercises which I couldn't do, because you had to do the exercises on the ground and I had a lot of difficulties with that. I was unable to perform the exercises well enough to really benefit from them.

Ri41: 'I wasn't sure if it was allowed to do this specific exercise in keeping in mind my sternum. There was immediately a tension on the wound'.

One participant said that receptive reading was difficult for that person which could cause the confusion in understanding the text with exercise instructions.

Other

Most of the participants (n=10) experienced the fixed training days as pleasant, because it gave them a structure.

Ri16: 'A structure is good. I found it clear, good, properly. I did not have to think anymore when I had to train again'.

Ri23: 'That's the fact, I was recovering in a structured way'.

Some participants (n=2) received technical support from their partners, one of them asked the partner when there were questions or something did not work, the other participant always received help from the partner because the partner operated the computer.

One participant had too little space in the computer room for doing the exercises.

Ri34: 'I have a room that is not really suitable for practicing. I could have done it better downstairs, but… I just bought that (is looking at laptop)'.

In summary, the training module was useful for almost all participants, most participants experienced multiple positive effects. The experiences about the ease of use of the training module differed. The text was experienced as clear equally often as unclear, the combination of the text and the video was often experienced as positive and the video was for almost all participants clarifying. A disadvantage according to most participants was that there were no exercises on the non-training days. Further, a couple of participants were motivated by their social network, but most of the participants were sufficiently motivated by their own. Besides a new training program every week, participants also received a new step goal every week. The experiences and attitudes of participants about the step goal are presented in the next paragraph.

3.2.3 Step goal

The step goal was presented in the online program. Participants received a Fitbit Zip for the duration of the study, this pedometer could monitor their daily steps. The experiences and attitudes of participants about the step goal and the pedometer are also presented based on the determinants: ease of use, usefulness, attitude, subjective norm, perceived behavioural control, and 'other'.

<u>Ease of use</u>

Eight participants experienced the pedometer as an easy to use device. For most of them it was a fixed pattern to put the pedometer on their belt or other clothes every morning.

Ri23: 'Yes, it is pretty simple. Just on the belt'.

However, three of them also indicated that they had problems with the pedometer. A total of seven participants experienced problems with the pedometer. One of them thought that the pedometer did not notice the right number of steps, three participants lost the pedometer, one participant did not understand how and when the pedometer resets the steps to zero, one participant did not succeed in correcting summer time to winter time, one participant did not understand the different screens of the pedometer and two participants had difficulties with removing the pedometer from their clothes.

The step goal was not noticed by one participant.

Ri29: 'I was not clearly demonstrated, or… not something like 'keep this in mind' or something'.

One participant found it unclear if it was allowed to divide the step goal throughout the day, and if it was allowed, how to do that.

Ri42: 'It was unclear, I didn't know whether the step goal was a total goal for that day, or if it should be a goal that should have been performed as one continuous exercise'.

<u>Usefulness</u>

Participants (n=5) thought that their physical condition was improved by means of the pedometer. Other participants said nothing about this subject spontaneously.

Attitude

Participants (n=8) were motivated by the step goal to go for a walk. They experienced the step goal as a trigger, a challenge and an encouragement. However, two participants were not motivated to go for a walk by means of the step goal. One of them made step goals for himself each day. The other participant was only motivated by the pedometer and not by the step goal in the online program, because the pedometer showed the amount and progression of his own steps. This participant and seven others (n=8) were motivated by the pedometer to go for a walk. The pedometer gave them insight in their steps, encouraged them and they experienced it as a challenge.

Subjective norm

Five participants were motivated by their partners to go for a walk, because partners told them to go for a walk or they went walking together. However, one participant was not motivated by the social network, and was motivated by himself to go for a walk.

Ri16: 'They do not have to motivate me, most of the time I motivate myself. […] I wanted to go for a walk, right from the start. A short, very short walk, and back'.

Perceived behavioural control

One participant was too much motivated by the step goal which caused this person to overdo the exercise which caused physical complaints.

Ri36: 'When I went for a walk, it is about 2000 steps, sometimes I went for a longer walk, and that was not good for my leg. Taking longer walks caused my leg to start misfunctioning, I started to make false steps. I'm aware of this, it always happens when I overdo the walking exercise.

In summary, the pedometer seems useful to improve the physical condition. The pedometer was experienced as an easy to use device almost as often as they experienced problems with it. However, participants were motivated by the pedometer and they were also motivated by the step goal to go for a walk. Further, the social network motivated participants to go for a walk. However, some participants were not motivated by the step goal or by their social network. Besides the step goal, other modules were offered in the online program. One of the other modules is the message or contact module. The experiences and attitudes of participants with the message or contact module are presented in the next paragraph.

3.2.5 Message or contact module

In the message or contact module, participants could send a message to a physiotherapist and the physiotherapist could give a response to that message. In this paragraph, it will become clear what the experiences and comments about the message or contact module were according to the participants.

Ease of use

For two participants, it was unclear if the evaluations were read by the physiotherapists. Both participants indicated that they had difficulty with a certain exercise, but did not receive a response from the physiotherapist.

Ri31: 'I didn't do some parts, and I made it known on the screen to the therapist, to adjust it or something, of which I had the idea: did they read it or not. I didn't notice that'.

Usefulness

Two participants called it useful that they could have contact with a physiotherapist. One of them was advised to perform the exercise in bed, so that the exercise could be performed properly. The other participant said that it gave a certain peace of mind to know that there was always a professional available for consultation.

Attitude

Participants (n=6) liked the option of contacting a physiotherapist, especially in case of pain, about exercises that were hard to perform or in case of general concerns or questions.

One participant said that it was not a problem to wait for an answer. However, another participant experienced it as unpleasant that it could take a week for an answer. Four participants preferred telephone or face-to-face contact, because then they received an answer immediately. Further, two participants missed an answer on the evaluation they had to fill in after a performed exercise.

Ri26: 'Great difficulty. I had great difficulty with that. And then I might expect from you something like: why did you had difficulty with that? Or why didn't you like it?'

Subjective norm

No comments were given regarding messages or contact that could be placed under subjective norm.

Perceived behavioural control

One participant did not send a message and the participant gave the following reason:

'No, I never did that, I am not a hero in that' (respondent ri43).

In summary, participants liked the message or contact module. Some participants experienced it as useful, it gave a certain peace of mind and the exercises could be performed properly by means of the received advise. However, participants found it unclear if the messages were read and they did not always receive an answer, therefore, some would prefer telephone contact. Besides the message or contact module, participants could also use another module: the supporting videos in everyday activities. The experiences and attitudes of participants with these videos are presented in the next paragraph.

3.2.6 Supporting videos in everyday activities

The supporting videos could help participants with the following everyday activities: knowing how to cough, transfer into and out of bed and how to sit down and stand up. In this paragraph, participants' comments about these videos are presented.

Ease of use

According to three participants, it was unclear what was mentioned under the tab page 'instruction videos', one participant looked at it out of curiosity, and one participant called it a confusing title.

Ri41: 'It is confusing. The simpler, the better.

- *Is it confusing that this are exercises?*

Yes, the videos are good, but I would reformulate it, like support in everyday activities or something. The title instruction videos… There are also instructions at the exercises'.

Usefulness

Participants (n=7) experienced the supporting videos as useful. A couple of participants experienced more than one positive effect. The supporting videos were useful to know how to cough (n=1), transfer into and out of bed (n=3), and how to sit down and stand up (n=4). Further, two participants indicated that the supporting videos were useful, but did not mention a positive effect they experienced.

Ri23: 'I can imagine that people have a look at it, and that it helps them remember the supporting physical activities they can do. So, I think that people can benefit from it.'

However, two participants indicated that the videos were unnecessary, the instructions from the hospital were clear enough and one of them added that it felt like an overload of information.

Attitude

Participants (n=5) had a positive attitude about these supporting videos. They found it good, pleasant and important that these videos were offered.

Subjective norm

No comments were given regarding supporting videos in everyday activities that could be placed under subjective norm.

Perceived behavioural control

No comments were given regarding supporting videos in everyday activities that could be placed under perceived behavioural control.

Other

Two participants indicated that they looked at the supporting videos, but they said this was only a few times. Three participants did not use the supporting videos, two of them did not know that these supporting videos were presented in the online program and the other participant did not use it because these instructions were already given in the hospital.

In summary, the supporting videos were useful for a lot of participants, they experienced different positive effects. It was good that these videos were offered in the program, according to most of the participants. However, some participants found it unnecessary. For a couple of participants, it was unclear what was mentioned with this module and some participants paid a little or no attention to these videos. Besides these videos, another supplementary module was presented in the online program: the information module. The experiences and attitudes of participants regarding the information module are presented in the next paragraph.

3.2.7 Information module

The information module existed of information about the recovery after the surgery and risk factors for heart diseases and healthy lifestyle. In this paragraph, the experiences with this module are presented.

Ease of use

No comments were given about the information module that could be placed under ease of use.

Usefulness

Participants (n=9) perceived the information module as useful, it gave them support and certainty.

Ri32: 'You know what you can do or who to contact when something is wrong. […] Something like that is always important, it is always important. […] It gives support. It helps me to consider what I'm allowed to do and what not'.

However, some participants (n=5) perceived the information module as unnecessary. Two of them received the information already from the hospital and found it unnecessary that the information was presented again in the online program.

Attitude

Participants (n=5) indicated the information as important.

Ri43: 'It is always important. You always… there is always information available and I think that is a part of the program'.

Subjective norm

No comments were given about the information module that could be placed under subjective norm.

Perceived behavioural control

No comments were given about the information module that could be placed under perceived behavioural control.

Other

Two participants did not look at the information because there were no problems and saw no reason to read the information. One participant only wanted to use the program for doing exercises and perceived the information as unnecessary. Besides, two participants did not pay attention to the information module and did not know the reason why they did not pay attention to it.

In summary, the information module was experienced as useful for most of the participants, however, some participants found the information module unnecessary. Participants indicated a couple of improvements to improve the information module. Not only improvements for the information module, but also improvements for the other modules of the program were mentioned. These improvements are presented in the next paragraph.

3.2.8 Improvements

Participants indicated a couple of potential improvements for the online program. These improvements are presented per module. First, the overall improvements according to participants are presented, subsequently improvements for the training module, the step goal and the pedometer, the message or contact module, the supporting videos and the information module.

Overall improvements

One participant said that offering the online program by means of an application would make it easier to use.

Ri23: 'I have thought: do I have to start up the device again? There is no app that you can do it on your phone'.

- *'Would it be more convenient if it was an app?'*

'Yes, I sometimes thought of that. It would be convenient because the smartphone is always at hand. I would like that.'

According to one participant, it would be appreciated when there was a more detailed explanation of the possibilities in the program, for example an introduction in the program.

One participant would have liked to be more controlled in the online program.

Ri26: 'I would say that I would just carry out a kind of check on those things. I say "yes I do participate, I have to do it"'.

The program focuses mainly on doing the exercises, but one participant would like to have more focus on walking.

Ri41: 'The strange thing is that walking seems to be a very good activity for people with heart problems, or all people… If that is one of the most important activities to keep your veins open, then you might think about what else you could do to encourage that'.

<u>Training module</u>

It would be more convenient when the option to send a message would be more visible (n=1). Further, one participant would like to see more clearly which button had to be clicked when the exercise was performed. For one participant, it would be more pleasant when the progression of the trainings was presented in the program. Another participant would like a more comprehensive evaluation after a training day:

Ri26: 'And that you can indicate that you're not agree with it or that you want another training. There should be an option to say what else you want in the training program'.

<u>Step goal</u>

One participant missed instructions about how to synchronize the pedometer. Another participant would like to receive a reminder to wear the pedometer, for example a reminder or message via the smartphone. Further, one participant preferred to count steps by means of the smartphone instead of a pedometer, because a pedometer could be lost faster than a smartphone. And one participant preferred it to take the personal situation of patients into account, for example an adjusted step goal due to physical disabilities. For the lay out of the step goal, one participant advised to make the step goal stand more out, for example by means of a colour or a notification.

<u>Messages or contact module</u>

One participant would prefer telephone or face-to-face contact, then he could tell the problem, which should be easier then texting the problem. One participant would prefer face-to-face contact with the therapists after 2 or 3 online training weeks, to evaluate the program which could lead to more trust and support for the next online training weeks. Two participants would find it an advantage when therapists respond more quickly to a message.

Ri41: Well, like I said, responding quickly. It would be nice to have a program that allows a near real live chat'.

Further, one participant thought it would be an improvement when he was notified when the physiotherapist has read the message. One person would like to see more interaction which could lead to more support:

Ri41: 'When it's more interactive, so when a physiotherapist or other professional gives a reaction, it becomes more interesting for the person who has to follow the program, for example: are you able to walk more? Then the professional sees only a few steps were performed, which he can then use in his feedback'.

Supporting videos in everyday activities

No improvements regarding supporting videos in everyday activities were mentioned by participants.

Information module

Two participants indicated improvements for the information module. One participant advised to add links of other information sources to the information module. The other participant would prefer to read information about the regular cardiac rehabilitation to be prepared for that training.

4. Discussion

The aim of this study was to evaluate the adherence with prescribed exercises, experiences and attitudes of patients included in the early e-health cardiac rehabilitation program. A log data analysis was conducted among all participants. The adherence of the participants ranged from 0% till 100% and the mean adherence was 63%. Fourteen participants were interviewed about how they experienced the online program. In general, participants were satisfied with the program, with a mean satisfaction grade of 8. The results of this study showed that participants got motivated to be physically active by means of the online program, the program offered them trust in what they were allowed to do, and they indicated that they gained better health outcomes by means of the online program. However, there were also participants who found it a disadvantage that they could not practice at non-training days. Another disadvantage was that participants experienced problems with the pedometer. Besides, participants perceived it as unclear if their messages were read and they indicated that it took a long time for receiving an answer from the health professional or they did not receive an answer on a message. Further, participants indicated a couple of improvements to improve the online program, for example, making some options more visible, presenting participants' progression, giving reminders to wear the pedometer and therapists should respond more quickly to messages.

Adherence with prescribed exercises

The adherence was measured by means of the amount of performed prescribed exercises, and not by means of the other modules of the program. Some modules could be skipped by patients while still being adherent to the overall program. The central (training) module was the most important module together with the step goal. Other modules were meant as support modules. According to Dishman (2001) and Robinson and Rogers (1994), approximately 50% of the adults who start an exercise program will, on average, drop out in a few months, even though it is well known that to obtain the better health outcomes

associated with physical activity, participation must be maintained. The mean adherence to the exercises was 63*%.* However, one third of the participants were between 0% and 58% adherent. One third of the participants showed an adherence above 80%. According to Rozenfeld, Hunt, Plauschinat and Wong (2008), a minimal of 80% is considered as good adherence in medication studies. According to Bassett (2003) a comparison of the effect of two different educational methods on adherence to home based exercises for low back pain showed participants given written and verbal information were more adherent (77%) to the exercises than those given verbal information only (38%). In another study adherence rates for exercises prescribed for patients with limb injuries were 74% for the number of exercise sessions and 70% for the number of repetitions performed at each session (Bassett and Petrie, 1999). This suggests that there is room for improvement. However, the adherence in our study might be underestimated due to incorrect log data. Some participants indicated that they did the exercises, but they did not know how to indicate that they performed the exercise at the online program, or they did the exercises on non-training days. These data were not logged.

Determinants of adherence

The results of this study show that most participants were pleased that it was a home-based program. They liked this, because they did not have to travel to an external location, preferred to train alone instead of training with others and they liked that the training could continue when they were not at home. This is in line with the review of Dalal (2010), who has shown that the disadvantages of centre-based programs were problems with accessibility and parking at the local hospital, dislike of groups and interference with work or domestic commitments. Home-based programs can potentially remedy these disadvantages. Participants indicated that the program was easy to use, because it was a home-based program. According to TAM, the perceived ease of use is the degree to which a person believes that using a particular system will be free of effort (Davis, 1989). Perceived ease of use would affect the intention to accept the program indirectly through the perceived usefulness (Lee et al., 2011). The easier the program is to use, the more useful it can be perceived (Gong and Yan, 2004). However, some participants did not experience it as pleasant that it was a home-based program, because they did not experience any encouragement in this way, and therefore they were not motivated by the program. Motivation is important because improved health can only occur if the participants exert effort. Maintaining the participants' motivation throughout the duration of the online program is important for the adherence to the program. Beside the aspects ease of use and usefulness of TAM, also other aspects were important for the motivation to use the online program, for example the aspect subjective norm of the TPB.

According to the TPB, the subjective norm is considered as a very important antecedence of the behaviour (Ajzen, 1991). A systematic review of Smith, Banting, Eime, O'Sullivan and van Uffelen (2017) suggested that people with greater social support for physical activity are more likely to do leisure time physical activities, especially when the social support comes from family members; and according to Won and Son (2017), social support from peers and family is known to improve self-care in chronic illnesses, including cardiac diseases. In addition, higher social support was found to be associated with faster cardiovascular recovery (Shen, McCreary and Myers, 2004). However, although the majority of the studies have shown that social support is an important influencer, the results of this study show that

participants did not place much value on the opinion of their social network regarding the use of the online program. It seems that usefulness, ease of use and other attitude aspects are more important than social influences. This is in line with the study of Husak, et al. (2004), who have shown that a lower social support did not significantly affect participation in rehabilitation. Participants indicated that the opinion of the social network did not motivate them. They said that when the benefits of the program were clear for themselves, they were sufficiently motivated by their own because they had to do the exercises for themselves to improve their own health. However, in relation to the subjective norm, the support of the health professional was very important for participants. According to TPB, subjective norm refers to the degree to which an individual believes that others who are important to the person think the person should perform a certain behaviour (Gong and Yan, 2004).) In this case, the health professionals were persons who were important for the participants. Participants indicated that given the severity of the health problems, participants relied more on professional support than on their social network/partners' support. According to van Dulmen (2001), continuity of health care and a long-term physician-patient relation have a positive influence on the patient's confidence and therefore increase the chance of improvement of the patient's health. In the message or contact module it is also shown that participants needed contact and confirmation from a professional.

Participants indicated that they found it pleasant that it were fixed training days, this gave them a structure. Interesting is that autonomy about whether to do the exercises was also perceived as pleasant. Besides, participants indicated that they found it a disadvantage that they had no choice to practice at non-training days. According to Martin and Dubbert (1985), providing participants with a choice about whether they want to participate in exercise programs has been suggested as a technique that positively influences adherence. Therefore, it is recommendable to retain fixed training days, but extend the training days with one extra day, so that participants do have a support to do the exercises on certain days, but also have a choice about whether to train on other days.

Persuasive elements which are classified by the Persuasive System Design (PSD) model of Oinas-Kukkonen and Harjumaa (2008) could be used to stimulate and motivate the participant to use the technology. There are different persuasive system principles. A few were already present in the online program, for example personalization (personal account and individual exercises) and self-monitoring (counting steps daily). Most of the improvements according to participants could be related to dialogue support: the possibility to make options more visible, offering reminders to motivate and stimulate exercising, and improving communication between users and therapists were considered as stimulating improvements by participants. The persuasive features could influence for example the ease of use and usefulness of the online program. For example, a reminder will make it easier for the participant to think about the program. If a system reminds the user of the target behaviour, the user will more likely achieve the goal (Oinas-Kukkonen and Harjumaa, 2009). Therefore, reminders will make the program more useful because participants will be more likely to achieve their goals. Further, making an option stand more out will make the online program possibly easier to use for the participant. According to Oinas-Kukkonen and Harjumaa (2009), a system that is visually attractive for its users is likely to be more persuasive. Therefore, the persuasive feature 'liking' could have a positive influence on the

actual use of the online program. Regarding primary-task support, participants would like to see more personalization (acknowledgement of receipt added at messages) and self-monitoring (overview of their progression) in the online program. The persuasive feature self-monitoring could have influence on the patient self-efficacy. By means of self-monitoring, participants are more aware of their own situation and experience a sense of safety, which could lead to more empowerment for the self-management of the disease (Pare et al., 2007). Adding these persuasive elements to the online program will possibly lead to an improved adherence to the online program. However, these persuasive features do not directly lead to actual behaviour, they only could contribute to the behaviour, for example a reminder does not ensure that participants actually performing the exercises, it only reminds the participants which make them aware and think about the exercises. Therefore, the persuasive features reinforce the relation between intention to perform a behaviour and performing the actual behaviour.

All fourteen participants used the training module. Interestingly, the other modules were less used by participants. A couple of participants indicated that they had no idea that other modules were offered in the online program. A possible explanation for this might be that the possibilities of the online program were not clear enough. It could be that unclear or minimal instructions were given about the online program, or it could be that participants forgot the instructions. Cognitive dysfunction is the most common clinical manifestation, such as deterioration in memory, attention (psycho)motor speed, and visuospatial ability. The incidence differed considerably, but may be as high as 50% to 70% at one week after cardiac surgery (Bruggemans, 2013). The instructions about this online program were given in the first week after cardiac surgery, therefore the instructions might possibly be too much information for participants, which could cause that not all modules were remembered by all participants. Further, some participants indicated that they did not pay attention to other modules. These participants possibly did not need these other modules and only wanted to use the central module of the online program.

Not all participants used the message or contact module, but the results of this study show that participants liked the option of contacting a therapist. Surprisingly, it could take a long time for receiving an answer or they even did not receive an answer. Participants also indicated that sometimes it was unclear if their messages were read. Therefore, some participants indicated that they preferred face-to-face contact, so that they receive an answer immediately. According to van Rooijen, Zwikker and van der Vliet (2012) there are more drop outs and patients are less adherent at online treatments compared to face to face treatments. Possible causes could be a poor design of the website, a difficult navigational structure, poor readability and because there is not enough adjustment to the needs of the participant. Postel, Witting and van Gemert-Pijnen (2013) indicated that the added value of adding face-to-face contact to online treatments is an improved client-friendliness. The combination of online and face-to-face therapy is called ‘blended care’ (Wentzel, van der Vaart, Bohlmeijer and van Gemert-Pijnen, 2016). Participants can experience it as pleasant to have face-to-face contact with the health professional one or more times. A personal meeting also offers more opportunities to stimulate and motivate the participant to participate the treatment (Postel, Witting and van Gemert-Pijnen 2013). According to Mohr et al. (2011), human support features intend to increase adherence behaviour, the therapeutic relationship is an important predictor of outcome in distance

treatments and it could influence adherence to e-health interventions. This is in line with the subjective norm according to TPB, the support of the health professional was very important for the participants. The professional's support encouraged participants and gave them trust to do the exercises with the aim to gain better health outcomes.

The TAM and TPB were used to gain insight in the attitudes and experiences with the online program. Almost all experiences and comments could be placed under the determinants of TAM and TPB. Most surprisingly was the subjective norm: participants did not place much value on the support of their social network. Participants indicated that they were sufficiently motivated by their own. However, the role of the health professional was very important for participants. They valued the support of the health professional and this support gave them trust. A couple of experiences and comments could not be placed under one of the determinants based on TPB or TAM, these experiences and comments were placed under 'other'. TAM and TPB are about rational behaviour, whereas the experiences and comments under 'other' were more about practical issues. The category 'other' is comparable with the external variables of TAM. Legris, Ingham and Collerette (2003) have shown that the external variables of TAM include for example, situational involvement and external computing support. Participants could have a high intention to perform the behaviour, but did not perform the behaviour because of other things like the flu or too little space for doing the exercises. It can be concluded that the Technology Acceptance Model and the Theory of Planned Behaviour actually served a useful framework to provide more clearness about the attitudes and experiences with the online program.

Online program offers trust

An important finding of this study was that the online program offered participants trust in a period of uncertainty, they indicated that they knew what they were allowed to do by means of the program. According to TAM, perceived usefulness is a good predictor of the individual's acceptance of the program and it directly affects users' behavioural intention to use it. The perceived usefulness reflects users' subjective probability that using the program will have positive effect on personal wellbeing (Lee et al., 2011). Recovery from coronary artery bypass surgery is widely recognized as a stressful experience. In the days after surgery, patients are confronted with uncertainty about treatment and the potential for complications. Patients experience uncertainty related to their ability to perform self-care while at home (Redeker, Allen, Jensen and Mishel, 1992). Because of the uncertainty, participants indicated that they did not know what they would have done if they had not participated in the online program. They indicated that they would possibly have prevented physical activities. However, by being physically active outcomes like mortality, cardiovascular events, functioning, cardiorespiratory measures, quality of life, cardiac functioning and exercise capacity can be positively influenced (Fell, Dale and Doherty, 2016). Therefore, it should be kept in mind that the online program offers participants an important support, which could be of great importance in the first weeks after such a high impact surgery.

Improvements according to participants

Two participants recommended to use other options instead of a website and a pedometer. According to one participant an application instead of a website would make the program easier to use. Another participant preferred to use their smartphone as step counter instead

of the pedometer. However, it should be kept in mind that these options probably would not make the program easier for every participant, because most participants are older people and do not have much experience with these devices. According to CBS (2016), 29 percent of the people older than 75 used a smartphone in 2016, against 54 percent of the people in the age range 65 to 75 years and 91 percent of the people in the 12 to 65 year-old age range. Other devices like the PC, laptop or tablet were used among 50 percent of the people aged over 75, the laptop (68%) was the most used device among people in the 65 to 75 year-old age range, and the laptop (81%) and smartphone (91%) were most used among people younger than 65. Therefore, some participants could prefer it to use the online program by means of a website, and other participants could prefer it by means of a mobile application. The same applies for counting the steps, not every participant has a smartphone. Therefore, it is recommendable to offer the online program in the current way (website) and in a new way, for example by means of an application. Participants themselves could give their preferences in which way they want to receive the online program. This is in line with the persuasive feature 'tailoring' of the PSD-model of Oinas-Kukkonen and Harjumaa (2009), the system will be more persuasive if it is tailored to the potential needs, interests, personality, usage context, or other factors related to the user group. When participants choose the online program by means of an application, but do not have a device that supports an application, it would be fine that they receive a device that supports the application for the duration of the online program.

One participant recommended to use reminders for wearing the pedometer, which could prevent to forget to wear the pedometer. This is in line with the study of Oinas-Kukkonen and Harjumaa (2009). They described persuasive features which stimulate the actual usage of a program. One of these persuasive features is 'reminders'. If a system reminds participants of their target behaviour, the participants will more likely achieve their goals (Oinas-Kukkonen and Harjumaa, 2009). It seems that reminders will have a positive influence on wearing the pedometer and achieving the step goal.

Two participants advised to make some options more visible, specifically the step goal and the option to send a message. One participant indicated to make the step goal stand more out by means of a colour or a notification. Oinas-Kukkonen and Harjumaa (2009) have shown that a system that is visually attractive is likely more persuasive. It seems that when these options are more attractive these options will probably be used more.

Strengths and limitations

The log data only consisted of information about exercises that have or have not been performed. Some participants did not know that they had to click the 'exercise performed' button after completing an exercise. Moreover, some participants did the exercises on other days than the prescribed training days, and therefore they could also not click on the button 'exercise performed'. The 'exercise performed' button was deactivated on non-training days in the online program. Therefore, it can be wondered how accurate the log data is. On the other hand, it is objective data which means that the data are facts and observations which were not influenced by individual feelings or prejudices.

This study used mixed methods, quantitative as well as qualitative methods. The qualitative method enabled participants to express their opinion. By means of the interviews, the

researcher could ask in-depth questions, which was not possible with a quantitative study. Therefore, insights were gained in what was important in the online program according to participants.

Eighteen participants of the online program were approached for an interview, three of them did not want to participate and one person was not reachable. Although only 14 patients participated in the interview, the response was high. Therefore, it is probably a representative sample of the patients who participated in the intervention which made selection bias less likely.

There are also some drawbacks in this study. The answers of the interviews were coded by one coder, more coders would improve the reliability of this study. A second coder could find other codes or could interpret it differently. However, some ambiguous codes were discussed with two other researchers. For example, concerning the codes 'motivation to be physically active' and 'motivation to go for a walk', it was ambiguous if it must be placed under perceived usefulness or under attitude. This was discussed with two other researchers and finally consensus was reached about the coding.

A limitation of this study was that saturation was not used. Given the time constraints, in the study fourteen interviews were conducted and new information was still obtained in the final interviews. According to Walker (2012) saturation ensures that adequate and quality data are collected, and may be the gold standard for qualitative research.

The interviews were retrospective, therefore it may have been difficult for participants to recall exactly what they experienced during the program. However, most recent participants (participation varied between 3 months till 8 months ago) were approached to participate the interview to minimize the chance that participants forgot important experiences.

Future research

Although the effectiveness of the online program is currently under evaluation, this study shows that the online program offers trust and motivation for participants to be physically active and actively participate in their revalidation. A cost-benefit analysis will show if the online program must be continued. The study shows some recommendations on how the online program can be improved. In the future, a randomized controlled trial needs to be conducted to determine if these improvements lead to a better effectivity and adherence to the online program.

Recommendations

Based on the experiences and attitudes of participants, a couple of recommendations to improve the program are given in this paragraph.

It was a disadvantage that participants could not perform exercises in the online program at non-training days. When participants had no time, or forgot to log in on the training days, they could not perform the training the next day. Therefore, it is recommendable to offer the training 48 hours instead of 24 hours, so that participants have more time to perform the exercises.

Further, it is recommendable to add reminders to the program, currently reminders do not exist in the program. When participants forget to do the exercises or to wear the pedometer, they could be reminded by means of a message or call at the time they prefer. According to the PSD-model of Oinas-Kukkonen and Harjumaa (2009), if a system reminds users of their target behaviour, the users will more likely achieve their goals. For example, when participants are not logged in at 6PM they will receive a reminder (message or call) on their (smart)phone, so that they are remembered to do the exercises and have an extra motivation to do it.

Participants indicated that it was unclear if their messages were read, it took a long time for receiving an answer or they even did not receive an answer at all. To keep participants using the online program, it is essential that an acknowledgement of receipt will be added at the message module of the online program, so that there is not an ambiguity if the messages were read. It is also recommendable that questions from patients are answered before the new training day, so that participants receive an answer on their question or concern before performing the next training. For future research, it is interestingly to investigate the response rates and timing of the response of the health care professional. The feedback of the health professional works probably motivating and is also very important for participants, because they valued the support of the health professional and it gave them trust. Because participants valued the health professionals' opinion, it is recommendable that the health professionals give feedback to participants by means of rewards. According to the PSD-model of Oinas-Kukkonen and Harjumaa (2009), rewards are persuasive features. Systems that reward target behaviours may have great persuasive powers. Further, it is recommendable to add face-to-face contact in the treatment, which make it a blended treatment. Blended care can positively influence the participant by offering more opportunities to motivate and stimulate the participant to participate the treatment (Postel, Witting and van Gemert-Pijnen, 2013).

For a couple of participants, it was unclear what could be expected under the tab page 'instruction videos'. Participants indicated that these videos were considered good and important, and some participants also experienced the videos as useful. Therefore, it is important to retain these videos but it is recommendable to change the title 'instruction video's' in for example, 'supporting videos in everyday activities'.

A couple of problems were experienced regarding the pedometer, and these do not contribute to the motivation to use the device. A better explanation of the pedometer appears necessary, or other pedometers must be used. The pedometer contains multiple screens with different options, like the number of steps, calories, distance etcetera. These multiple options could be confusing for participants, therefore it is recommendable to use pedometers with only one screen which shows the number of steps.

Some participants indicated that they found it disappointing that their progression was not mentioned in the online program. To show participants where they are working on and what their progress is, it is recommendable to show their results. This is in line with the study of Oinas-Kukkonen and Harjumaa (2009); one of the persuasive features they described is 'self-monitoring': a system that keeps track of an individual's own performance or status supports the user in achieving their goals. Currently, the only results they could see are their

performed exercises versus their prescribed exercises. It is recommendable to give an overview of the progression of amount of performed exercises, the severity of the exercises and the results of the evaluation (ratings of perceived exertion) after the exercises. Through this, participants will self-manage their progression. An e-health technology, like telemonitoring can positively influence self-management. A review of Pare et al. (2007) has shown positive effects of telemonitoring on attitude and behaviour of participants. By means of the telemonitoring, participants were able to actively participate their health care recovery. Participants were more aware of their own situation and experience a sense of safety, which could lead to more empowerment for the self-management of the disease. Besides, according to DeWalt et al. (2006), self-management programs for patients with heart disease can reduce hospitalizations and mortality. Therefore, it is important that patients can manage their progress at the online program. Self-management offers control over their health, and could be important in proceeding the online program.

The videos were experienced as a strength of the training module. It is important that these videos be retained in the program, because the videos clarify the exercises, according to almost all participants.

Conclusion

Participants were in general satisfied with the online program. The most important finding was that the online program offered participants trust, they know what they were allowed to do by means of the program. Another important finding was that the program was experienced as a support to be physically active. Participants were motivated to do the exercises and most of them did not need motivation of their social network. Besides, the feedback of the health professional works probably motivating and is also very important for participants, because they valued the support of the health professional and this also gave them trust. A disadvantage was that there were few persuasive features added in the program. Adding persuasive features such as reminders, self-monitoring and rewards could stimulate and motivate the use of the program even more.

References

Anderson, L., Oldridge, N., Thompson, D. R., Zwisler, A. D., Rees, K., Martin, N., & Taylor, R. S. (2016). Exercise-based cardiac rehabilitation for coronary heart disease: Cochrane systematic review and meta-analysis. *Journal of the American College of Cardiology*, *67*(1), 1-12.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179-211.

Bassett, S. F. (2003). The assessment of patient adherence to physiotherapy rehabilitation. *New Zealand journal of physiotherapy*, *31*(2), 60-66.

Bassett, S. F., & Petrie, K. J. (1999). The effect of treatment goals on patient compliance with physiotherapy exercise programmes. *Physiotherapy*, *85*(3), 130-137.

Bruggemans, E. F. (2013). Cognitive dysfunction after cardiac surgery: Pathophysiological mechanisms and preventive strategies. *Netherlands Heart Journal*, *21*(2), 70-73.

Car, J., Tan, W. S., Huang, Z., Sloot, P., & Franklin, B. D. (2017). eHealth in the future of medications management: personalisation, monitoring and adherence. *BMC medicine*, *15*(1), 73.

CBS. (2016). *75-plussers sterkst groeiende groep internetters*. Retrieved on 5 January 2018 from https://www.cbs.nl/nl-nl/nieuws/2016/52/75-plussers-sterkst-groeiende-groep-internetters

Creswell, J. W., & Clark, V. L. P. (2007). Designing and conducting mixed methods research.

Dafoe W, Arthur H, Stokes H. Universal access: But when? Treating the right patient at the right time: Access to cardiac rehabilitation. The Canadian Journal of Cardiology. 2006;22(11):905-11.

Dalal, H. M., Zawada, A., Jolly, K., Moxham, T., & Taylor, R. S. (2010). Home based versus centre based cardiac rehabilitation: Cochrane systematic review and meta-analysis. *British Medical Journal*, *340*, b5631.

Daly, J., Sindone, A. P., Thompson, D. R., Hancock, K., Chang, E., & Davidson, P. (2002). Barriers to participation in and adherence to cardiac rehabilitation programs: a critical literature review. *Progress in cardiovascular nursing*, *17*(1), 8-17.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Dekker-van Weering, M. G. H., Vollenbroek-Hutten, M. M. R., & Hermens, H. J. (2016). Adherence to an online exercise program for COPD patients in the home environment-a pilot study. *Health and technology*, *6*(4), 259-268.

DeWalt, D. A., Malone, R. M., Bryant, M. E., Kosnar, M. C., Corr, K. E., Rothman, R. L., ... & Pignone, M. P. (2006). A heart failure self-management program for patients of all literacy levels: a randomized, controlled trial [ISRCTN11535170]. *BMC health services research*, *6*(1), 30.

Dishman, R. K. (2001). The problem of exercise adherence: Fighting sloth in nations with market economies. *Quest*, *53*(3), 279-294.

Dubach, P., Myers, J., & Wagner, D. (1998). Optimal timing of phase II rehabilitation after cardiac surgery. The cardiologist's view. *European heart journal*, *19*, O35-7.

van Dulmen, S. (2001). De helende werking van het arts-patiëntcontact. *Huisarts en wetenschap*, *44*(11), 194-198.

Eysenbach, G. (2001). What is e-health?. *Journal of medical Internet research*, *3*(2).

Eysenbach, G. (2005). The law of attrition. *Journal of medical Internet research*, *7*(1), e11. doi:10.2196/jmir.7.1.e11

Fell, J., Dale, V., & Doherty, P. (2016). Does the timing of cardiac rehabilitation impact fitness outcomes? An observational analysis. *Open heart*, *3*(1), e000369.

Free C, Phillips G, Galli L, Watson L, Felix L, et al. (2013) The Effectiveness of Mobile-Health Technology-Based Health Behaviour Change or Disease Management Interventions for Health Care Consumers: A Systematic Review. PLoS Med 10(1): e1001362. doi:10.1371/journal.pmed.1001362

Gong, M., & Yan, K. (2004). Applying technology acceptance model, theory of planned behavior and social cognitive theory to mobile data communications service acceptance. *PACIS 2004 Proceedings*, 35.

Husak, L., Krumholz, H. M., Lin, Z. Q., Kasl, S. V., Mattera, J. A., Roumanis, S. A., & Vaccarino, V. (2004). Social support as a predictor of participation in cardiac rehabilitation after coronary artery bypass graft surgery. *Journal of Cardiopulmonary Rehabilitation and Prevention*, *24*(1), 19-26.

Jolly, K., Taylor, R. S., Lip, G. Y., & Stevens, A. (2006). Home-based cardiac rehabilitation compared with centre-based rehabilitation and usual care: a systematic review and meta-analysis. *International journal of cardiology*, *111*(3), 343-351.

Kelders, S. M., Kok, R.N., Ossebaard, H.C., Van Gemert-Pijnen, J.E.W.C. (2012). "Persuasive system design does matter: a systematic review of adherence to web-based interventions." Journal of Medical Internet Research 14(6).

Kraal, J. J., Peek, N., van den Akker-Van, M. E., & Kemps, H. M. (2013). Effects and costs of home-based training with telemonitoring guidance in low to moderate risk patients entering cardiac rehabilitation: The FIT@ Home study. *BMC cardiovascular disorders*, *13*(1), 82.

Lee, Y. H., Hsieh, Y. C., & Chen, Y. H. (2013). An investigation of employees' use of e-learning systems: applying the technology acceptance model. *Behaviour & Information Technology*, *32*(2), 173-189.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & management*, *40*(3), 191-204.

Martin, J. E., & Dubbert, P. M. (1985). Adherence to exercise. *Exercise and sport sciences reviews*, *13*(1), 137-168.

Mathieson, K. (1991). Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. *Information systems research*, *2*(3), 173-191.

Mohr, D. C., Cuijpers, P., & Lehman, K. (2011). Supportive accountability: a model for providing human support to enhance adherence to eHealth interventions. *Journal of medical Internet research*, *13*(1).

Oh, H., Rizo, C., Enkin, M., & Jadad, A. (2005). What is eHealth (3): a systematic review of published definitions. *Journal of medical Internet research*, *7*(1).

Oinas-kukkonen, H., & Harjumaa, M. (2008). A Systematic Framework for Designing and Evaluating Persuasive Systems. *Persuasive*, 164–176.

Oinas-Kukkonen, H., & Harjumaa, M. (2009). Persuasive systems design: Key issues, process model, and system features. *Communications of the Association for Information Systems*, *24*(1), 28.

Paré, G., Jaana, M., & Sicotte, C. (2007). Systematic review of home telemonitoring for chronic diseases: the evidence base. *Journal of the American Medical Informatics Association*, *14*(3), 269-277.

Park, N., Rhoads, M., Hou, J., & Lee, K. M. (2014). Understanding the acceptance of teleconferencing systems among employees: An extension of the technology acceptance model. *Computers in Human Behavior*, *39*, 118-127.

Pope, C., Ziebland, S., & Mays, N. (2000). Qualitative research in health care: analysing qualitative data. *BMJ: British Medical Journal*, *320*(7227), 114.

Postel, M. G., Witting, M., & van Gemert-Pijnen, J. E. (2013). Blended behandeling in de geestelijke gezondheidszorg. *Dth: kwartaaltijdschrift voor directieve therapie en hypnose*, *33*(3), 210-221.

Redeker, N. S., Allen, M. N., Jensen, L., & Mishel, M. H. (1992). The relationship between uncertainty and coping after coronary bypass surgery. *Western Journal of Nursing Research*, *14*(1), 48-68.

Robison, J., & Rogers, M. A. (1994). Adherence to exercise programmes. *Sports Medicine*, *17*(1), 39-52.

Rogers EM. Diffusion of innovations. New York: Free Press; 2003.

van Rooijen, K., Zwikker, N. & van der Vliet, E. (2012). Wat werkt bij online hulpverlening? Retrieved on 01 May 2018 from http://www.dejeugdprofessional.info/wp-content/uploads/2014/10/Wat-werkt-bij-online-hulp-20121.pdf

Rozenfeld, Y., Hunt, J. S., Plauschinat, C., & Wong, K. S. (2008). Oral antidiabetic medication adherence and glycemic control in managed care. *The American journal of managed care*, *14*(2), 71-75.

Scalvini, S., Zanelli, E., Comini, L., Dalla Tomba, M., Troise, G., Febo, O., & Giordano, A. (2013). Home-based versus in-hospital cardiac rehabilitation after cardiac surgery: a nonrandomized controlled study. *Physical therapy*, *93*(8), 1073-1083.

Shen, B. J., McCreary, C. P., & Myers, H. F. (2004). Independent and mediated contributions of personality, coping, social support, and depressive symptoms to physical functioning outcome among patients in cardiac rehabilitation. *Journal of behavioral medicine*, *27*(1), 39-62.

Smith, G. L., Banting, L., Eime, R., O'Sullivan, G., & van Uffelen, J. G. (2017). The association between social support and physical activity in older adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *14*(1), 56.

Walker, J. L. (2012). The use of saturation in qualitative research. *Canadian Journal of Cardiovascular Nursing, 22, 37–46.*

Wentzel, J., van der Vaart, R., Bohlmeijer, E. T., & van Gemert-Pijnen, J. E. (2016). Mixing online and face-to-face therapy: how to benefit from blended care in mental health care. *JMIR mental health*, *3*(1).

WHO. 2017. *Cardiovascular diseases (CVDs)*. Retrieved on 1 November 2017 from http://www.who.int/mediacentre/factsheets/fs317/en/

WHO. (n.d.). *eHealth at WHO.* Retrieved on 1 November 2017 from http://www.who.int/ehealth/about/en/

Won, M. H., & Son, Y. J. (2017). Perceived social support and physical activity among patients with coronary artery disease. *Western journal of nursing research*, *39*(12), 1606-1623.

Appendix A: PSD-model

Principle	Definition	Example
Primary Task Support		
Reduction	A system that reduces complex behaviour into simple tasks helps users perform the target behaviour, and it may increase the benefit/cost ratio of a behaviour	Smoking cessation website provides an interactive test that measures how much money a user will save with quitting
Tunnelling	Using the system to guide users through a process or experience provides opportunities to persuade along the way	Smoking cessation website offers information about treatment opportunities after a user has taken an interactive test about how addicted the person is on tobacco
Tailoring	Information provided by the system will be more persuasive if it is tailored to the potential needs, interests, personality, usage context, or other factors relevant to a user group	Website for recovering alcoholics presents stories that are close to the user's own story
Personalization	A system that offers personalized content or services has a greater capability for persuasion	Arguments most likely to be relevant for the user presented first on a professional website rather than in random order
Self-monitoring	A system that keeps track of one's own performance or status supports the user in achieving goals	Mobile phone application presents daily step count
Simulation	System that provide simulations can persuade by enabling users to observe immediately the link between cause and effect	Before-and-after pictures of people who have lost weight are presented on a website
Rehearsal	A system providing means with which to rehearse a behaviour can enable people to change their attitudes or behaviour in the real world	A flying simulator to help flight pilots practice for severe weather conditions
Dialogue Support		
Praise	By offering praise, a system can make users more open to persuasion	Mobile application that aims at motivating teenagers to exercise praises user by sending automated text messages for reaching individual goals
Rewards	Systems that reward target behaviours may have great persuasive powers	Heart rate monitor gives users a virtual trophy if they follow their fitness program
Reminders	If a system reminds users of their target behaviour, the users will more likely achieve their goals	Caloric balance monitoring application sends text messages to its users as daily reminders
Suggestion	Systems offering fitting suggestions will have greater persuasive powers	Application for healthier eating habits suggests that children eat fruits instead of candy at snack time
Similarity	People are more readily persuaded through systems that remind them of themselves in some meaningful way	Slang names are used in an application which aims at motivating teenagers to exercise
Liking	A system that is visually attractive for its users is likely to be more persuasive.	Website that aims at encouraging children to take care of their pets properly has pictures of cute animals
Social role	If a system adopts a social role, users will more likely use it for persuasive purposes	E-health application has a virtual specialist to support communication between users and health specialists

Principle	Definition	Example
System Credibility Support		
Trustworthiness	A system that is viewed as trustworthy will have increased powers of persuasion	Company website provides information related to its products rather than simply providing biased advertising or marketing information
Expertise	A system that is viewed as incorporating expertise will have increased powers of persuasion	Company website provides information about their core knowledge base
Surface credibility	People make initial assessments of the system credibility based on a firsthand inspection	There are only a limited number of, and a logical reason for, ads on a website or mobile application
Real-world feel	A system that highlights people or organization behind its content or services will have more credibility	Company website provides possibilities to contact specific people through sending feedback or asking questions
Authority	A system that leverages roles of authority will have enhanced powers of persuasion	Website quotes an authority, such as a statement by government health office
Third-party endorsements	Third-party endorsements, especially from well-known and respected sources, boost perceptions on system credibility	E-shop shows a logo of a certificate that assures that they use secure connections
Verifiability	Credibility perceptions will be enhanced if a system makes it easy to verify the accuracy of site content via outside sources	Claims on a website are supported by offering links to other web sites
Social Support		
Social learning	A person will be more motivated to perform a target behaviour if the person can use a system to observe others performing the behaviour	A shared fitness journal in a mobile application for encouraging physical activity
Social comparison	System users will have a greater motivation to perform the target behaviour if they can compare their performance with the performance of others	Users can share and compare information related to their physical health and smoking behaviour via instant messaging application
Normative influence	A system can leverage normative influence or peer pressure to increase the likelihood that a person will adopt a target behaviour.	A smoking cessation application shows pictures of newborn babies with serious health problems due to the mother's smoking habit
Social facilitation	System users are more likely to perform target behaviour if they discern via the system that others are performing the behaviour along with them	Users of a computer-based learning environment can recognize how many co-students are doing their assigned homework at the same time as them
Cooperation	A system can motivate users to adopt a target attitude or behaviour by leveraging human beings' natural drive to co-operate	The behavioural patterns of overweight patients are studied through a mobile application, which collects data and sends it to a central server where it can be analysed at the group level in more detail
Competition	A system can motivate users to adopt a target attitude or behaviour by leveraging human beings' natural drive to compete.	Online competition, such as Quit and Win (stop smoking for a month and win a prize)
Recognition	By offering public recognition for an individual or group, a system can increase the likelihood that a person/group will adopt a target behaviour	Personal stories of the people who have succeeded in their goal behaviour are published on a smoking cessation website

(Oinas-Kukkonen and Harjumaa, 2009)

Appendix B: Informed consent

Proefpersoneninformatie voor deelname aan medisch-wetenschappelijk onderzoek

Addendum

Het effect van een online oefenprogramma in de vroege hartrevalidatie fase na een openhartoperatie

Geachte heer/mevrouw,

U heeft onlangs meegedaan aan een onderzoek naar het effect van een online oefenprogramma in de vroege hartrevalidatie fase na een openhartoperatie. Nogmaals onze dank hiervoor. Graag willen wij aanvullend de ervaringen van patienten met het online oefenprogramma evalueren. Wij vragen u dan ook vriendelijk om mee te werken aan een interview hierover. Deelname is vrijwillig. Voordat u beslist of u wilt meewerken aan dit interview, krijgt u uitleg over het doel en de opzet van het interview.

Achtergrond en doel van het interview
Na uw openhartoperatie hebt u een online oefenprogramma aangeboden gekregen. Met dit programma kon u vanuit huis in een vroege fase al starten met uw revalidatie, onder begeleiding van de fysiotherapeut. Met behulp van vragenlijsten is gekeken naar het effect van dit programma op uw lichamelijk en geestelijk functioneren. Daarnaast is de 6-minuten wandeltest afgenomen. Door middel van een interview zouden we graag dieper willen ingaan op uw ervaringen met het programma. Welke effecten hebt u bijvoorbeeld zelf ervaren? En wat waren redenen om het programma wel of niet te gebruiken? Uw ervaringen zullen gebruikt worden om het online oefenprogramma te verbeteren.

Opzet van het interview
Indien u wenst mee te werken, zal er een interview plaatsvinden waarin vragen gesteld worden over uw ervaringen met het online oefenprogramma. Dit interview zal maximaal 45 minuten van uw tijd in beslag nemen. Van het interview wordt een audio opname gemaakt. Het interview zal woordelijk uitgetypt worden, waarna het audiobestand gewist wordt.

Geen vergoeding voor meedoen

U ontvangt geen financiële vergoeding voor deelname aan het interview. Wel ontvangt u reiskostenvergoeding voor een eventueel extra bezoek aan het ziekenhuis.

Overige informatie

Alle apecten (bijv. ten aanzien van gebruik en bewaren van gegevens, mogelijkheid tot raadplegen onafhankelijk arts) die eerder genoemd zijn in de patienteninformatie (zie bijlage), blijven voor dit interview ook van kracht.

Ten slotte

De onderzoeker zal over een week telefonisch contact met u opnemen. Tijdens dit telefonisch contact hebt u de mogelijkheid om vragen te stellen en kunt u uw keuze kenbaar maken of u *wel* of *niet* wilt meewerken aan het interview. Als u *niet* wenst deel te nemen, hoeft u hiervoor geen reden op te geven. Als u *wel* wenst mee te werken, zal de onderzoeker een datum, tijdstip en locatie voor het interview met u afspreken. Wij vragen u het toestemmingsformulier alvast in te vullen. Tijdens het interview kunt u dit aan de onderzoeker geven. Door uw schriftelijke toestemming geeft u aan dat u de informatie heeft begrepen en instemt met deelname aan het interview.

Onderzoeksteam

Dr. Martine Veehof (hoofdonderzoeker)
Ergotherapeut / bewegingswetenschapper
Paramedische Zorg MST
Mailadres: M.Veehof@mst.nl
Telefoon: 06-11769873

Cherique Spenkelink
Student Gezondheidspsychologie
Universiteit Twente
Mailadres: C.Spenkelink@mst.nl
Telefoon: 06-11773109

Toestemmingsformulier, addendum

Het effect van een online oefenprogramma in de vroege hartrevalidatie fase na een openhartoperatie

- Ik heb eerder meegedaan aan een onderzoek naar het effect van een online oefenprogramma in de vroege hartrevalidatie fase na een openhartoperatie.
- Ik geef hierbij toestemming voor een aanvullend interview over mijn ervaringen met het programma.
- Ik weet dat er een audio opname van het gesprek gemaakt wordt. Deze opname wordt gewist nadat het interview woordelijk uitgetypt is.
- Ik weet dat alle aspecten die in de eerdere patienteninformatie genoemd zijn, ook voor dit interview van kracht zijn.

Naam:

Handtekening: Datum : __ / __ / __

Appendix C: Interview questions

Algemeen gebruik

1. Wat vond u van het online programma?

2. Heeft u gebruik gemaakt van het online programma?
- Zo ja, van welke onderdelen heeft u gebruik gemaakt (bv. Informatie module, trainen, contact module).
- Hoe vaak heeft u het online programma gebruikt?
- Welke redenen had u ervoor om het oefenprogramma wel/niet te gebruiken?

3. Heeft u baat gehad bij het online programma?
- Kunt u vertellen waarom u wel/geen baat had bij het programma?

4. Hoe tevreden bent u met het online programma in het algemeen op een schaal van 1 tot 10, waarbij 1 helemaal niet tevreden en 10 geheel tevreden?
- Kunt u dit toelichten?

5. Wat vond u goed/niet goed aan het online programma?
- Kunt u dit toelichten?

6. Heeft u problemen ervaren m.b.t. het inloggen of het doorlopen van het online programma?
- Zo ja, kunt u vertellen welke problemen dat waren?
- Was het makkelijk om het programma te leren gebruiken?
- Had u voldoende aan de instructies/handleiding?
- Kunt u dit toelichten?

7. Het programma is een online programma, u heeft kunnen oefenen waar u wilde, en wanneer u wilde op de aangegeven dagen, 's ochtends, 's middags of 's avonds.
   In hoeverre was dit belangrijk voor u op een schaal van 1 tot 5, waarbij:
   1. Helemaal niet belangrijk
   2. Niet belangrijk
   3. Neutraal
   4. Wel belangrijk
   5. Geheel belangrijk
- Kunt u dit toelichten?

8. Vroege hartrevalidatie is de revalidatie in de eerste 6 weken na de operatie. Reguliere hartrevalidatie is de revalidatie die 6 weken na de operatie begint (de fit-training bij de fysiotherapeut)
   Hoe kijkt u, na afronding van dit onderzoek, aan tegen het trainen in de eerste 6 weken na de operatie?
- Kunt u dit toelichten?

Module: Trainen

In het programma had u toegang tot een trainingsmodule. *Trainingsmodule doornemen op laptop*

1. Heeft u gebruik gemaakt van deze module?

2. Wat vond u goed/niet goed aan deze module?
- Kunt u dit toelichten?

3. Er stonden 3 keer per week (maandag, woensdag en vrijdag) oefeningen voor u klaar. Wat vond u van het aantal oefendagen (3 keer per week)?
- Wat vond u ervan dat u op vastgestelde dagen kon oefenen?

4. Wat vond u van de hoeveelheid oefeningen die u kreeg?
- Kunt u dit toelichten?

5. Wat vond u van de soort oefeningen die u kreeg?
- Welke soort oefeningen vond u nuttig/niet nuttig?
- Waren er oefeningen waar u moeite mee had?
- Kunt u dit toelichten?

6. Had u thuis voldoende ruimte en rust om te oefenen (kinderen, partner etc.)?
- Kunt u dit toelichten?

7. Vindt u dat het trainen heeft bijgedragen aan uw herstel?
- Kunt u dit toelichten?
- Welke positieve effecten heeft u ervaren?
- Kunt u dit toelichten? – *bijv. op welke manier heeft u deze effecten ervaren?*

8. Heeft u tips voor de trainingsmodule?

Stappendoel

1. Wat vond u ervan om een stappendoel te krijgen?

2. Heeft het stappendoel invloed gehad op uw motivatie om te wandelen?
- Kunt u dit toelichten?

3. Lukte het u om de fitbit te dragen?
- Heeft u de fitbit altijd gedragen?
- Kunt u dit toelichten?

4. Heeft u tips voor het onderdeel ‘stappendoel’?

Modules: Berichten en Contact

In het programma had u toegang tot een berichten- en contact module. *Modules doornemen op laptop*

1. Heeft u gebruik gemaakt van een van de modules?
- Welke redenen had u ervoor om wel/geen gebruik te maken van deze module(s)?

2. Was het verschil tussen de berichten- en contact module voor u duidelijk?
- Kunt u dit toelichten?

3. Wat vond u goed/niet goed aan de module(s)?
- Kunt u dit toelichten?

4. Hoe belangrijk vond u het om contact te hebben met een professional op een schaal van 1 tot 5, waarbij:

1. Helemaal niet belangrijk
2. Niet belangrijk
3. Neutraal
4. Wel belangrijk
5. Geheel belangrijk

- Kunt u aangeven waarom u het niet belangrijk/neutraal/wel belangrijk vond?

5. Heeft u reactie(s) gekregen van de therapeut?
- Zo ja, wat vond u van de reactie(s)?

6. Vond u dat er voldoende contact was of had u het graag anders gezien?
- Kunt u dit toelichten?

7. Heeft u baat gehad bij deze berichten/contact module?
- Kunt u dit uitleggen?

8. Heeft 'het communiceren met een professional/fysiotherapeut' invloed gehad op uw motivatie om thuis te oefenen?
- Wat maakt het dat dit u wel/niet beïnvloed heeft?

9. Weten uw naaste familie/vrienden dat u gebruik maakte van dit oefenprogramma?

10. Vonden uw naaste familie/vrienden het belangrijk dat u gebruik maakte van dit programma?

11. Hielpen uw naaste familie/vrienden u met het oefenprogramma?
- Op welke manier hielpen zij u?

12. Motiveerden uw naaste familie/vrienden u om gebruik te maken van het oefenprogramma?
- Kunt u dit toelichten?

13. Heeft u tips voor de berichten module? En voor de contact module?

Modules: Home, Informatie, Instructiefilmpjes

1. Heeft u gebruik gemaakt van deze module?
- Welke redenen had u ervoor om wel/geen gebruik te maken van deze module?

2. Wat vond u goed/niet goed aan deze module?
- Kunt u dit toelichten?

3. Vond u de informatie belangrijk?
   Kunt u aangeven waarom u dit wel/niet belangrijk vond?

4. Heeft u baat gehad bij deze module?
- Kunt u dit uitleggen?

Heeft u tips voor deze module?

Tips

1. Heeft u verder nog tips voor het online programma?