Technology can`t replace people, but it is a helpful tool: A qualitative study on patients' experiences of using a smartphone-application post-cardiac rehabilitation

Pernille Lunde, Asta Bye, Kari Anette Bruusgaard, Elisabet Hellem, Birgitta Blakstad Nilsson

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Abstract

Background: Exercise-based cardiac rehabilitation (CR) is a crucial part of the treatment of patients with cardiac diseases and adherence of healthy behavior is a prerequisite to improve long-term prognosis. Unfortunately, adherence to healthy behavior adapted in CR is challenging for many cardiac patients in the long-term. Recently, we demonstrated that follow-up conducted via an application (app) for one year significantly improved adherence to healthy behavior post-CR. In order to increase the knowledge and understanding of mobile Health (mHealth) interventions that can promote acceptance and adherence, qualitative research investigating patients' experiences with these interventions are warranted.

Objective: The aim of this study was to investigate patient experiences with individualized long-term follow-up conducted via an app for one year and their thoughts about what features promoted adherence to healthy behavior post-CR. This to increase the understanding of significant findings previously reported as well as to guide future development of similar interventions in the field of adherence.

Methods: Ten patients who had participated in a randomized controlled trial evaluating the effect of follow-up conducted via an app on adherence to healthy behavior post-CR were included in this qualitative study with individual semi-structured, in-depth interviews. Median age was 65, ranging from 46 to 72 years old, and both genders were represented. Interviews were analyzed by qualitative content analysis. Primarily, codes and themes were inductively developed.

Results: The analysis resulted in four themes describing the patients' experiences with follow-up conducted via an app for one-year post-CR: 1) The person behind the app is crucial for motivation and adherence, 2) The app as a commitment, 3) The app as a path to independence, and 4) Suggestions for improvements. Additionally features experienced as beneficial to promote adherence were individualized feedback as well as the use of goalsetting. The significance of the person behind the app that provided individualized feedback turned out to be a consistent finding. This person seemed to promote motivation in general and to enable other known behavioral change techniques to be motivating as well.

Conclusions: The person behind the app (the supervisor) seems to be one of the main features which promoted adherence to healthy behavior post-CR. This indicates that healthcare providers must actively participate in the patients´ process of adherence to healthy behavior, also when using interventions including an app. Future development of interventions in the field of adherence should strive to develop tools that enable an ongoing collaborative relationship between the patient and the healthcare provider. The follow-up should be based on the patient's own goals and individualized feedback should be provided.

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Exercise-based cardiac rehabilitation (CR) is a crucial part of the treatment of patients with cardiac diseases and adherence of healthy behavior is a prerequisite to improve long-term prognosis. Unfortunately, adherence to healthy behavior adapted in CR is challenging for many cardiac patients in the long-term. Recently, we demonstrated that follow-up conducted via an application (app) for one year significantly improved adherence to healthy behavior post-CR. In order to increase the knowledge and understanding of mobile Health (mHealth) interventions that can promote acceptance and adherence, qualitative research investigating patients' experiences with these interventions are warranted.

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Conclusions:

The person behind the app (the supervisor) seems to be one of the main features which promoted adherence to healthy behavior post-CR. This indicates that healthcare providers must actively participate in the patients´ process of adherence to healthy behavior, also when using interventions including an app. Future development of interventions in the field of adherence should strive to develop tools that enable an ongoing collaborative relationship between the patient and the healthcare provider. The follow-up should be based on the patient's own goals and individualized feedback should be provided.

Keywords:

mHealth, cardiac rehabilitation, mobile phone app, smartphone, lifestyle

Introduction

Exercise-based cardiac rehabilitation (CR) is a crucial part of the treatment of patients with cardiac diseases and is a Class IA recommendation in European guidelines [1, 2]. The overall goal of secondary prevention, including CR, is to prevent subsequent cardiac events [2, 3]. Despite that adherence of healthy behavior is a prerequisite to improve long-term prognosis, the majority of cardiac patients do not achieve the guideline standard for secondary prevention in the long-term [2, 4]. Research evaluating interventions that aims to improve adherence to healthy behavior post-CR is therefore warranted [2].

Mobile health (mHealth) interventions have been proposed to meet challenges related to adherence of healthy behavior and have thus been suggested as potential interventions post-CR [2, 5-7]. In particular, smartphone-applications (apps) have been considered promising due to their ability to monitor patients' health from anywhere at any time [5, 8]. Additionally, previous research has highlighted the need of individualizations of such interventions [9, 10]. Recently, we have demonstrated the feasibility of using an app to provide individualized follow-up in patients post-CR [11]. Based on results from this study we developed and conducted a randomized controlled trial (RCT) aiming to evaluate the effect of individualized follow-up with an app for one year on health outcomes relevant for adherence of healthy behavior in patients' post-CR [12]. Patients in the intervention group received access to an app where they added individual goals and accompanying tasks [12, 13]. They were monitored and followed by a supervisor (specialized physiotherapist) for a year. The app itself provided reminders and evaluations of tasks and weekly goal achievement, and the patient could write notes related to each goal. Patients in the intervention group received comprehensive individualized feedback, based on their goals and what they had done, through e-mail every week for the first 12 weeks, and every fourth week for rest of the year. Throughout the year they also received one to three short motivational messages every week. These messages were written individually to each patient. However, sometimes the content could be of a more general nature. Additionally, patients could submit questions to the supervisor and receive answer within two working days throughout the year [12, 13]. The results demonstrated that using the app significantly improved peak oxygen uptake, exercise performance, exercise habits and self-perceived goal achievement, compared with a control group that received usual care post-CR [12]. All patients allocated to the intervention group used the app, and as much as 71% used the app daily and/or weekly throughout the year [12].

The high acceptance and use of the app in our study was unique as difficulties or low acceptance in

using the technology is a frequent obstacle in similar interventions [14]. In order to increase the knowledge and understanding of mHealth functions and components that can promote acceptance and adherence, qualitative research investigating patients' experiences with these interventions is urged. Such knowledge is important for future design of apps and interventions to increase patients' benefits from apps, with a view to increase adherence to healthy behavior.

To our knowledge, no former studies have explored patients' experiences with individualized mHealth interventions lasting for a whole year. The purpose of the present study was to increase the understanding of the significant findings previously reported [12], and to guide future development of similar interventions in the field of adherence. Our aim was to investigate patient experiences with individualized long-term follow-up conducted via an app for one year to gain increased knowledge about which features promoted adherence to healthy behavior post-CR.

Methods

A qualitative study with individual interviews was conducted to describe patients' experiences with a long-term follow-up intervention conducted via an app. The interviews were planned to be completed within two weeks after the end of the follow-up period of one year in the previously mentioned RCT [12].

Recruitment and participants

Participants were recruited from the RCT [12] ($n = 113$) which evaluated the effect of individualized follow-up with an app for one-year post-CR. Enrolment in the RCT was carried out at two CR centers in the eastern part of Norway from October 2017 to June 2018. These CR centers offered, in total, three different CR programs: 12 weeks outpatient CR, four-week inpatient CR and one-week inpatient CR. The randomization was stratified by the CR program to ensure equal participation and thereby representativeness.

At the one-year follow-up assessment, participants in the intervention group were recruited to the present study. In addition to accepting participation, living nearby Oslo (maximum 1-hour transport away) was set as an inclusion criterion as the interviews were planned conducted at Oslo Metropolitan University (OsloMet) in Oslo, Norway. Efforts were made to ensure that participants were representative for the CR population in the eastern part of Norway, including both genders, participating in different CR programs as well as different ages.

Ten patients with a median age of 65 (range 46-72 years) participated in the study (see Table 1). More than half of the patients were retired. The majority had participated in a 4-weeks inpatient CR-program or a 12-weeks outpatient CR-program before inclusion to the RCT. Number and type of

goals are presented in Table 1. All patients had their own goals or tasks related to exercise and/or physical activity. Additionally, seven of the patients had goals related to weight loss or maintenance of bodyweight, and accompanying tasks were specific nutritional advice learned or implemented in primary CR. Nine of the patients attended the interview as scheduled, while one was unable to attend until 4 weeks after the follow-up assessment, due to other medical and social appointments.

Table 1. Characteristics of the patients

	n
Gender	
Males	9
Females	1
Age distribution	
40-49	1
50-59	2
60-69	5
70-79	2
Civil status	
Married/cohabiting	8
Single	2
Employment status	
Employed	3
Retired	6
Disability benefits	1
Disease	
Coronary artery disease	7
Valve surgery	3
Type of cardiac rehabilitation	
One week	1
Four weeks	4
Twelve weeks	5
Smartphone	
iPhone	7
Android	3
Number of goals	
One goal	4
Two goals	6
Type of goal	
Exercise related goal	9
Weight loss/maintenance goal	7

Interviews and interview guide

Individual interviews were completed from November 2018 to May 2019. The interviews were carried out at OsloMet. One participant chose to complete the interview digitally due to several unforeseen appointments that made it difficult to attend physically. To ensure sufficient quality on the audio-recording, Skype for Business was used. The interviews lasted from 35 to 62 minutes (44 minutes on average) and were carried out by two researchers (KAB and EH) who did not take part in the RCT of which the participants were recruited from. Both interviewers had experience from CR

and qualitative research. To ensure as comprehensive material as possible, all interviews were carried out with both researchers present.

A thematic interview guide (Multimedia Appendix 1) was used when conducting the semi-structured in-depth interviews. The aim was to maintain an open, nonjudgmental attitude. Emphasis was placed on listening to the responses to open-ended questions and allowing the participants to fully explain a phenomenon, together with an invitation to reflect upon their experiences [15]. The interviews were audio-recorded and transcribed successively during the period in which the interviews were conducted. Initially, the texts were managed and systematized by Microsoft Word® and by working manually with printouts and pen and paper. Thereafter, texts were imported to, managed, and systematized by NVivo®. Quotations from the texts were translated from Norwegian to English by the first author (PL), and then validated by all co-authors.

Data analysis

Transcribed interviews were analyzed by a thematic coding technique based on Braun and Clarke´s [16] framework, which is a method for identifying, analyzing and reporting patterns within qualitative data. The method includes six phases: 1) familiarization with the data, 2) generating initial codes. 3) searching for themes, 4) reviewing themes, 5) defining and naming themes and 6) writing the report [16]. The codes and themes were inductively developed.

Initially, the analysis involved repeated readings of each transcript by all the authors to obtain an overall impression of the material. The next phase involved coding the entire dataset on a semantic level. Specifically, we focused on the parts of the data that revealed relevant information and descriptions regarding the current overall research question. Further, codes that revealed similar aspects of the data were grouped into preliminary themes, which were checked for consistency and variability within and across interviews. Subsequently, we identified and interpreted four overarching themes in a constant process of moving between the data, potential themes and maps made for visualization, as well as reference to relevant literature and discussions and mutual understanding among the authors. Finally, themes were established if they were coherent and represented the meanings found in the interviews [16]. Throughout the analytic process, all findings were discussed and validated within the research group. In case of inconsistencies, further discussions and reflections were used to resolve it.

Ethical considerations

The present study was approved by the Regional Committee for Medical and Health Research Ethics (South-East ID: 2016-1476) as a sub-study of the previously described RCT. All included patients

provided written informed consent.

Results

The patients' experiences with long-term follow-up conducted via an app to promote adherence to healthy behavior post-CR evolved within the following four themes: 1) The person behind the app is crucial for motivation and adherence, 2) The app as a commitment, 3) The app as a path to independence, and 4) Suggestions for improvements. One of these overarching themes (1) were abstracted to sub-themes.

There person behind the app is crucial for motivation and adherence

All patients in the study highlighted that the person behind the app (the supervisor), was considered a prerequisite to succeed with the intervention. However, this person can`t be just anyone. The patients highlighted that the person must possess a set of characteristics which primarily help create a relationship based on trust between the supervisor and the patient, and in turn help to make the app motivating and thereby help them to adhere to healthy behavior. Personal characteristics of special importance included engagement, professional competence, care, and support.

> *You know, she is not just anyone, the fact that she gets involved and shows care and engagement in me as a person. At least I perceive it as if she wants my best, and she gives the advice that is for my best.*

> Participant 1

> *It is the whole person behind it, from whom you can almost experience a kind of love, and a person who is engaged in you.*

> Participant 10

Three subthemes evolved from the theme "The person behind the app is crucial for motivation and adherence": a) Individualized feedback, b) Follow-up based on own goals and c) A lifebuoy in the event of unforeseen events. The person behind the app was the common denominator for all three sub-themes.

Individualized feedback

An important motivating factor, which was highlighted by all patients in the present study, was the individual feedback that each one received throughout the study period. The person behind the app made it possible to provide tailored feedback, advice and guidance which seems to have been a success criterion. The tailoring should be based on the patients´ individual condition, the form of the day as well as the patients´ likes and dislikes. This reinforces the feeling that the feedback is directed

at the individual, and not in general. Several of the patients used other general health apps during the intervention period. They pointed out the difference between individual feedback and automated feedback.

> *I do not really believe in apps providing feedback automatically. So, this app is great because there is a person providing the feedback, which means that the feedback is directed solely to you. That is, I think that is crucial, because this is what's motivates me.*
>
> Participant 8

> *The fact that there was a physical person, that you actually knew at the other end, who provided individualized feedback and you had the opportunity to communicate with, was extra motivating. This made it easier to keep up the good work.*
>
> Participant 7

Follow-up based on own goals

The person behind the app enabled the follow-up to be based on individualized goals which most patients highlighted as important to increase motivation.

> *I think that's pretty essential (setting your own goals). Of course, the more you personify this, the better it is. And of course, following them then. However, those goals could have been more nuanced. Maybe there could have been a few more.*
>
> Participant 3

A lifebuoy in the event of unforeseen events

Some of the patients experienced dramatic events that caused a significant setback during the year of follow-up. They expressed that for them, most likely, the app and follow-up had been extra important for long-term adherence to healthy behavior. In these cases, the patients experienced that it was absolutely crucial that there was a person behind the app with whom they had an established and trustful relationship.

> *If I didn't have the app, or should I say "her"….. If I didn't have her at that time, I think I would have had great trouble getting to where I am today…, so fast... I would probably have walked and strolled a bit, but I would not have been able to physically be where I am today. Because of that (setback), I needed help in a proper way… not like "you have to do this, and you have to do that." …But something motivating and encouraging, and that is exactly what I got from her.*
>
> Participant 4

Additionally, adjustments and flexibility in goalsetting processes and the accompanying tasks were

highlighted as central. This seems to be particularly important after dramatic events, when patients often must take one day at a time.

For me it has certainly had an extra great significance, because it was a bit like a crisis, and she came out with suggestions for alternatives to the goals I had set myself.

Participant 1

The app as a commitment

Several of the patients described that the app, and the follow-up, provided a form of commitment. The patients expressed that the app committed in different ways, where the commitment to the person behind the app turned out the most evident.

To be honest, I did not want to disappoint the supervisor, because she had been so motivating. So, my wife said, "It doesn't matter what I say, but when she says it, then it is important." So, maybe there`s something in it.

Participant 4

Several of the patients also expressed a commitment to the research project as a motivating factor. However, the distinction between the research project and the person behind the app was not clear.

We also knew that we were part of a research project, so you kind of felt it was a bit important what you were doing. Or at least, it could make a difference to her work. That she was involved, and that it was fun to try to take it seriously…. and then, the idea with that app and the follow-up was that you should try to be as clever as possible…. that was a good motivation.

Participant 10

Finally, the patients expressed that the app also gave a commitment to themselves. To be challenged at their individual level was highlighted as motivating. Some patients described that they used the note function in the app and wrote a diary to give themselves an extra challenge, beyond the one they received from the supervisor.

I posted such a summary, that this week I have completed 4x4 intervals, while this week I have had pyramid intervals […]. So, it was a small summary for each week, and I really appreciated it because it was very nice to be able to scroll through, and it gave a motivation to keep up the good work and to challenge myself. It also gave me bad conscience if I did not exercise enough.

Participant 7

The app as a path to independence

The patients expressed that they experienced the downward adjustment regarding frequency of

comprehensive feedback, also known as individualized feedback, as overwhelming and a bit scary. Despite this, the downgrading was perceived as important to increase independence while they at the same time felt safe and supported on a regular basis. Additionally, they knew they could easily get in touch with the supervisor if needed.

> *Right away it was a little shocking, like "Oh? Is it only once a month, now?" It was so nice with that attention…. But then, sort of, yes, that was the deal. I have reached a higher level…. Now, I must be more independent. […] I must keep it going by myself, so in that sense it gives a natural transition. But I felt like I had been living in a suite, a first-class suite, and then suddenly, I was down to third class, sort of.*

<div align="right">Participant 10</div>

Most of the patients expressed that the feeling of safety which the app gave them was important to promote and push themselves to the activities that they needed to reach their goals. In particular when the frequency on the comprehensive feedback was downgraded, this safety was extra important. Through the nine months with less frequent follow-up, they got the chance to experience that they were able to adhere to their program almost by themselves.

> *So, at that time when the frequency was downgraded, I was a bit alone. However, with that app and follow-up, you have a direct link to the expertise in a way, which is both reassuring and motivating. […] It was a very good security, it`s like wearing a parachute. You don't have to use it, but you know it`s there.*

<div align="right">Participant 7</div>

Suggestions for improvements

Despite the promising result in the RCT regarding the effect of follow-up with the app, we also analyzed the qualitative data to illuminate potential for improvements to optimize future interventions in the field of adherence. Overall, patients expressed high satisfaction with the app and justified this with the fact that it was easy to use. Most of the patients considered the app to be a tool, enabling human interaction.

> *So, technology can`t replace people, but it is a helpful tool*

<div align="right">Participant 1</div>

Nevertheless, two suggestions for improvements clearly evolved. This was related to ownership of own goals and self-perceived goal achievement. Although most of the patients found it both meaningful and motivating that the use of the app and the follow-up was based on their own goals, ownership to some of the patient's goals could be questioned. Some of the patients expressed their

goals were made by healthcare providers at the CR center before completing CR. As a result, they did not necessarily consider the goals to be their own. Additionally, the opportunity to change goals along the way was raised as a potential improvement. Unforeseen events may occur at any time, which may affect the possibility of achievements and ownership of previous set goals. This demands greater flexibility in goalsetting throughout the year. Finally, in the RCT, patients in the intervention group were asked to rate self-perceived goal achievement on a Likert-scale (0-100) weekly [12, 13]. All patients in the present study expressed that this question was difficult to answer, and several of the patients described the scale and question as abstract.

Discussion

Principle findings

Our findings indicate that for a patient to have the full benefit of an app to increase adherence to healthy behavior post-CR, there must be a supervisor behind the app who possess some special characteristics. Confidence in the supervisor seems to be what enables other highlighted functions and components of the app to be perceived as motivating in relation to adherence. Other features of the app highlighted by the patients was the app´s possibility to provide individualized feedback and that the use of the app was based on own goals. Additionally, the app provided a form of commitment, either to the person behind the app, to being a participant in a research project and/or to themselves. Finally, to succeed in the hard work of adherence to healthy behavior post-CR, patients highlighted the importance of gradual phasing out the follow-up and feedback from the supervisor.

All patients in the present study highlighted the importance of the person behind the app. They described how their experiences with the supervisor´s engagement, care, and support as well as professional competence promoted motivation to adhere to healthy behavior. The trust-based relationship between the patient and supervisor could be considered a prerequisite for other components of the intervention promoting motivation to adherence to healthy behavior. As far as the authors know, no qualitative studies evaluating patients´ experiences using apps have clearly stated the essence of a person behind the technology. On the other hand, this finding is not surprising as a concept analysis of adherence in the context of cardiovascular risk reduction states that adherence implies active participation and collaboration and is dependent on a concordant relationship between the patient and the health care provider [17]. A trustful relationship with a healthcare provider has been considered crucial in establishing strong adherence to healthy behavior [17]. An ongoing collaborative relationship between the patient and the healthcare provider is considered one of the most important attributes of successful adherence [18].

In the present study, all patients experienced the feedback as particularly meaningful because it was individually tailored. Individual tailoring demands a person behind the app who administers the feedback. Feedback has been emphasized in the framework for the development of mobile technology use in CR [5]. In particular, individualized feedback has been proposed as a superior technique for long-term success [5, 19], and may reflect the attributes of ongoing support and collaboration with a healthcare provider [17]. It may also reflect the supervisor´s ability to influence the patients´ self-efficacy [20]. People with high self-efficacy are more likely to believe that they can change their behavior than people with low self-efficacy. A positive association between self-efficacy and adherence to exercise is described in people with coronary heart disease [21]. This is in line with a narrative review which states the importance of self-efficacy in exercise adherence in patients with chronic heart failure [22]. Exercise and exercise-based CR which improves physical function seems to be beneficial in order to increase self-efficacy in exercise adherence [22]. We also believe that a prerequisite for the supervisor to succeed in strengthening the patient's self-efficacy using an app, is that the patient has participated in an exercise-based CR-program prior to the follow up with the app, such as in our study. Patients in our RCT were recruited from exercise-based CR-programs, and one of the centers documented significant improvement of peak oxygen uptake after their 12 weeks CR-program [23].

Another factor mentioned by most patients as important for creating motivation was that the app and the follow-up provided a commitment. The commitment was three folded, where the commitment to the person behind the app seemed to be the strongest. However, commitment to oneself also evolved as an important factor. The apps´ possibility to self-monitoring worked as a personal challenge and was described to be of value to adherence. We believe that this finding can be understood in the light of the app providing internal motivation. Internally motivated changes are considered significant for success in adherence to long-term behavioural changes [17, 24].

Another attribute of successful adherence is experiencing the achievements of one´s goals [18]. Most of the patients described that it was important that the app and the follow-up were based on their own goals. Some even felt that this was essential to promote motivation. Goalsetting is established as an effective technique in behavioral change and setting specific goals has been shown to be effective for increasing post-CR patients´ level of physical activity, both in terms of frequency and duration [19]. However, guidance in setting goals that are small, important for the patient, specific and achievable is essential to succeed with the technique [25]. Even though both CR-centres included in the present study considered goalsetting with the patient important, and the supervisor was an experienced physiotherapist from CR, some patients still described an absence of ownership to their goals.

Goalsetting seems to be of great importance and strategies for implementation of the process should be highlighted in future similar interventions in the field of adherence. The importance of ownership to one`s goals should not be underestimated. To maintain goals as a motivating factor for adherence to long-lasting interventions there is a need for flexibility in terms of changing goals in line with changing needs.

The use of behavior change theory in crafting interventions has shown more powerful effects compared to interventions not based on theory [26]. The same applies to technology-based interventions. Applying behavior change theory is associated with an increased likelihood of effects in technology-based interventions [27]. The theoretical framework is important in understanding how changes are achieved [27, 28]. The intervention evaluated in the present study was based on the transtheoretical model (TTM) of behavior change, also known as the stages of change model [29]. According to this model, behavioral change is a process that rarely occurs in a linear manner [29]. Some of the patients experienced unforeseen events resulting in setbacks during the process towards permanent changes. They described the app and the tailored follow-up in the setback stage as a lifebuoy that helped them come back on the right track. The transtheoretical model emphasizes that setbacks in terms of moving back to a lower stage of change, i.e. from the stage of maintenance to the stage of action or preparation, is more common than unusual [29]. Further, TTM emphasizes that the need for support may be different at different stages and should be tailored to increase the likelihood of successful behavior change [29].

Interestingly, no patients suggested technical improvements of the app directly. However, many patients experienced the weekly rating (0-100) of self-perceived goal achievement as difficult and pointless. Therefore, a concrete improvement of the intervention would be to remove this component. Overall, the satisfaction with the intervention, including the technical solution of the app was high, and the use of the app was high [12]. We believe that a reason for this was that the RCT followed the Medical Research Council complex intervention framework [28, 30], i.e. a careful and structured development of the intervention, based on evidence base and a theoretical framework [11, 31, 32]. A greater degree of ownership of goals was another suggestion for improvement. This will be carefully assessed and taken into account in our future planned implementation study. Additionally, we believe that a potential improvement could be that the patient's supervisor should be assigned based on the patient's goals. For example, it can be beneficial if the supervisor is a nutritionist if the patients' goals are primarily diet related. This was not explicitly mentioned by the patients, but is based on the fact that more than half of the patients had goals related to weight loss, and results from the RCT did not demonstrate any statistically significant effect on bodyweight [12].

Whether or not our findings are unique is hard to say as few comparable studies exist. However, a recently published systematic qualitative grounded theory review aimed at investigating barriers to and facilitators of technology in CR and self-management [33] support our findings. Background knowledge, ongoing support and in-the-moment understanding, as well as personalization and gamification were concluded as facilitators [33].

Methodological reflections and limitations

The strength of the present study is that patients from all three CR-programs were invited to participate in the interviews, thus, representing the heterogeneity of patients in CR, including both genders, younger and older and living in rural and urban areas. This strengthens the credibility of the data. However, few women and few patients who originally attended the one-week CR-program were included. Their experiences therefore emerge to a somewhat lesser extent compared to men and patients who originally attended a four- or 12-weeks CR-program. The project leader (PL) strived to recruit a couple of more women and a couple of more patients originally from the one-week CR-program, but due to the inclusion criteria of living nearby Oslo it was not possible. To ensure trustworthiness, all authors collaborated on the data analysis. The fact that we were five researchers conducting the analysis is expected to strengthen the dependability and the overall trustworthiness. The sample size can be regarded as small, but the interviews were nuanced, and we considered the material to be saturated after eight interviews. This view was also valid after ten interviews when we decided to end the data collection.

The purpose of qualitative research is directed toward providing in-depth explanations and meanings rather than generalizing findings [34]. The term "Transferability" is used to express to what degree the findings can be applied to other contexts. The transferability of the present study has to be judged by the reader. We hope to have highlighted some phenomena that may have relevance for comparable patient populations and situations, such as in app-based interventions aiming to promote adherence to healthy behavior in patients with lifestyle diseases.

Since the interviews were conducted after the end of the intervention in the RCT, oversights and recall biases of relevant experiences and suggestions for improvement cannot be ruled out. Interviews during different phases of the intervention, i.e., after three, six and 12 months, could have resulted in more accurate snapshots of the patients´ experiences.

Regarding the researchers position and preconceptions, the first author´s firsthand experiences with the intervention through being project coordinator and supervisor for all patients included in the RCT, may have influenced. For example, the overall idea of evaluating patients' experiences and thereby the choice of research question was based on regularly feedback from patients during the

RCT. Further, the two co-authors (AB and BBN) engagement in the RCT of which the present study builds on, may also have influenced. Even though all the authors have professional and research interests in the field of health science, there was a diversity among authors backgrounds (physiotherapy and dietetics) as well as a diversity in relation to authors experiences with the use of technology and their previously engagement in the RCT. This led to interesting discussions and enhanced reflexivity [35]. The overall experiences of the researchers of the present study, most likely, means that there were certain things that we took for granted. However, it also means that we were well positioned to understand the context and to perform the study [36].

Conclusions and Implications

Overall, an appreciation of the person behind the app turned out to be a consistent finding. This person seemed to promote motivation in general and seemed to enable other known behavioral change techniques to be motivating, such as feedback and goalsetting. Therefore, the person behind the app (the supervisor) seems to be one of the main reasons for the high acceptance and use of the app, and consequently, important for the results in the RCT [12]. We therefore conclude that healthcare providers must actively participate in the patients´ process of adherence and that the use of the app should not be considered a substitute, but a reinforcement in motivational work to promote adherence to healthy behavior post-CR. Future development of interventions in the field of adherence should therefore strive to develop tools that enable an ongoing collaborative relationship between the patient and the healthcare provider, provide follow-up based on the patient's own goals, of which they have an ownership, and provide feedback and support at the stage of change that the patient is at, at any given time.

Acknowledgment

Conflicts of Interest

None declared.

Multimedia Appendix

Multimedia Appendix 1: Thematic interview guide

Abbreviations

CR: cardiac rehabilitation
RCT: randomized controlled trial
TTM: the transtheoretical model

References (Husk legg inn Pubmed ID)

1.   Ambrosetti M, Abreu A, Corrà U, Davos CH, Hansen D, Frederix I, et al. Secondary prevention through comprehensive cardiovascular rehabilitation: From knowledge to implementation. 2020 update. A position paper from the Secondary Prevention and Rehabilitation Section of the European Association of Preventive Cardiology. European journal of preventive cardiology. 2020:2047487320913379. PMID: 33611446

2.   Piepoli MF, Hoes AW, Agewall S, Albus C, Brotons C, Catapano AL, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice. Atherosclerosis. 2016;252:207-74. PMID: 27664503

3.   Piepoli MF, Corra U, Adamopoulos S, Benzer W, Bjarnason-Wehrens B, Cupples M, et al. Secondary prevention in the clinical management of patients with cardiovascular diseases. Core components, standards and outcome measures for referral and delivery: a policy statement from the cardiac rehabilitation section of the European Association for Cardiovascular Prevention & Rehabilitation. Endorsed by the Committee for Practice Guidelines of the European Society of Cardiology. Eur J Prev Cardiol. 2014;21(6):664-81. PMID: 22718797

4.   Kotseva K, Wood D, De Bacquer D, De Backer G, Rydén L, Jennings C, et al. EUROASPIRE IV: A European Society of Cardiology survey on the lifestyle, risk factor and therapeutic management of coronary patients from 24 European countries. European Journal of Preventive Cardiology. 2016;23(6):636-48. PMID: 25687109

5.   Beatty AL, Fukuoka Y, Whooley MA. Using Mobile Technology for Cardiac Rehabilitation: A Review and Framework for Development and Evaluation. Journal of the American Heart Association. 2013;2(6):e000568-e. PMID: 24185949

6.   Hamine S, Gerth-Guyette E, Faulx D, Green BB, Ginsburg AS. Impact of mHealth chronic disease management on treatment adherence and patient outcomes: a systematic review. Journal of medical Internet research. 2015;17(2):e52. PMID: 25803266

7.   Gandhi S, Chen S, Hong L, Sun K, Gong E, Li C, et al. Effect of mobile health interventions on the secondary prevention of cardiovascular disease: systematic review and meta-analysis. Canadian Journal of Cardiology. 2017;33(2):219-31. PMID: 27956043

8.   Marzano L, Bardill A, Fields B, Herd K, Veale D, Grey N, et al. The application of mHealth to mental health: opportunities and challenges. The Lancet Psychiatry. 2015;2(10):942-8. PMID: 26462228

9.   Woods LS, Duff J, Roehrer E, Walker K, Cummings E. Patients' experiences of using a consumer mhealth app for self-management of heart failure: mixed-methods study. JMIR human factors. 2019;6(2):e13009. PMID: 31045504

10.   Georgsson M, Staggers N. Patients' perceptions and experiences of a mHealth diabetes self-management system. CIN: Computers, Informatics, Nursing. 2017;35(3):122-30. PMID: 27748662

11.   Lunde P, Nilsson BB, Bergland A, Bye A. Feasibility of a Mobile Phone App to Promote Adherence to a Heart-Healthy Lifestyle: Single-Arm Study. JMIR Formative Research. 2019;3(2):e12679. PMID: 31066684

12.   Lunde P, Bye A, Bergland A, Grimsmo J, Jarstad E, Nilsson BB. Long-term follow-up with a smartphone application improves exercise capacity post cardiac rehabilitation: A randomized controlled trial. European Journal of Preventive Cardiology. 2020:204748732090571. PMID: 32106713

13.   Lunde P, Bye A, Bergland A, Nilsson BB. Effects of individualized follow-up with a smartphone-application after cardiac rehabilitation: protocol of a randomized controlled trial. BMC Sports Science, Medicine and Rehabilitation. 2019;11(1). PMID: 31768261

14.   Park LG, Beatty A, Stafford Z, Whooley MA. Mobile phone interventions for the secondary prevention of cardiovascular disease. Progress in cardiovascular diseases. 2016;58(6):639-50. PMID: 27001245

15.   Malterud K. Systematic text condensation: a strategy for qualitative analysis. Scandinavian journal of public health. 2012;40(8):795-805. PMID: 23221918

16.   Braun V, Clarke V. Using thematic analysis in psychology. Qualitative research in psychology. 2006;3(2):77-101. DOI: 10.1191/1478088706qp063oa

17.   Cohen SM. Concept analysis of adherence in the context of cardiovascular risk reduction. Nurs Forum. 2009;44(1):25-36. PMID: 19187051

18.   Bosworth HB, Oddone EZ, Weinberger M. Patient treatment adherence: Concepts, interventions, and measurement: Psychology Press; 2006.

19.   Ferrier S, Blanchard CM, Vallis M, Giacomantonio N. Behavioural interventions to increase the physical activity of cardiac patients: a review. European Journal of Cardiovascular Prevention & Rehabilitation. 2011;18(1):15-32. PMID: 20502341

20.   Bandura A. Self-efficacy: toward a unifying theory of behavioral change. Psychological review. 1977;84(2):191.

21.   Slovinec D'Angelo ME, Pelletier LG, Reid RD, Huta V. The roles of self-efficacy and motivation in the prediction of short-and long-term adherence to exercise among patients with coronary heart disease. Health Psychology. 2014;33(11):1344. PMID: 25133848

22.   Ha FJ, Hare DL, Cameron JD, Toukhsati SR. Heart failure and exercise: a narrative review of the role of self-efficacy. Heart, Lung and Circulation. 2018;27(1):22-7. PMID: 28969981

23.   Nilsson BB, Lunde P, Holm I. Implementation and evaluation of the Norwegian Ullevaal model as a cardiac rehabilitation model in primary care. Disabil Rehabil. 2017;41(4):481-8.

PMID: 29105515

24.   Ryan RM, Lynch MF, Vansteenkiste M, Deci EL. Motivation and autonomy in counseling, psychotherapy, and behavior change: A look at theory and practice The Counseling Psychologist. 2011;39(2):193-260.

25.   Miller WR, Rollnick S. Motivational interviewing : helping people change. 3rd ed. New York: Guilford; 2013.

26.   Glanz K, Rimer BK, Viswanath K. Health behavior: Theory, research, and practice: John Wiley & Sons; 2015.

27.   Webb TL, Joseph J, Yardley L, Michie S. Using the Internet to Promote Health Behavior Change: A Systematic Review and Meta-analysis of the Impact of Theoretical Basis, Use of Behavior Change Techniques, and Mode of Delivery on Efficacy. Journal of Medical Internet Research. 2010;12(1):e4. PMID: 20164043

28.   Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: the new Medical Research Council guidance. BMJ. 2008:a1655. PMID: 18824488

29.   Prochaska JO, Redding CA, Evers KE. The transtheoretical model and stages of change. In: Glanz K, Rimer BK, Viswanath K, editors. Health behavior: Theory, research, and practice: Wiley-Blackwell; 2015. p. 125-48.

30.   Craig P, Dieppe P, Macintyre S, Michie S, Nazareth I, Petticrew M. Developing and evaluating complex interventions: The new Medical Research Council guidance. International Journal of Nursing Studies. 2013;50(5):587-92. PMID: 23159157

31.   Richards DA, Hallberg IR. Complex interventions in health: an overview of research methods: Routledge; 2015.

32.   Lunde P, Nilsson BB, Bergland A, Kværner KJ, Bye A. The Effectiveness of Smartphone Apps for Lifestyle Improvement in Noncommunicable Diseases: Systematic Review and Meta-Analyses. Journal of Medical Internet Research. 2018;20(5):e162. PMID: 29728346

33.   Tadas S, Coyle D. Barriers to and Facilitators of Technology in Cardiac Rehabilitation and Self-Management: Systematic Qualitative Grounded Theory Review. Journal of medical Internet research. 2020;22(11):e18025. PMID: 33174847

34.   Carminati L. Generalizability in qualitative research: A tale of two traditions. Qualitative health research. 2018;28(13):2094-101. PMID: 30043686

35.   Malterud K. Qualitative research: standards, challenges, and guidelines. The lancet. 2001;358(9280):483-8. PMID: 11513933

36.   Berger R. Now I see it, now I don't: Researcher's position and reflexivity in qualitative research. Qualitative research. 2015;15(2):219-34.

Supplementary Files

Multimedia Appendixes

Thematic interview guide.
URL: http://asset.jmir.pub/assets/bbf2f6317bd74874c5cb41e7e6740bb7.docx