Heart & Lung xxx (2017) 1–8

Contents lists available at ScienceDirect

Heart & Lung

journal homepage: www.heartandlung.org

Exploring patient experiences and perspectives of a heart failure telerehabilitation program: A mixed methods approach

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ARTICLE INFO

Article history:
Received 5 November 2016
Received in revised form
4 March 2017
Accepted 10 March 2017
Available online xxx

Keywords:
Cardiac failure
Exercise
Telemedicine
Qualitative research
Telerehabilitation

ABSTRACT

Objectives: To describe patient experiences and perspectives of a group-based heart failure (HF) telerehabilitation program delivered to the homes via online video-conferencing.
Background: Limited information currently exists on patient experiences of telerehabilitation for HF. Patient feedback and end-user perspectives provide important information regarding the acceptability of this new delivery model which may have a substantial impact on future uptake.
Methods: We used mixed-methods design with purposive sampling of patients with HF. We used self-report surveys and semi-structured interviews to measure patient experiences and perspectives following a 12-week telerehabilitation program. The telerehabilitation program encompassed group-based exercise and education, and were delivered in real-time via videoconferencing. Interviews were transcribed and coded, with thematic analysis undertaken.
Results: Seventeen participants with HF (mean age [SD] of 69 [12] years and 88% males) were recruited. Participants reported high visual clarity and ease of use for the monitoring equipment. Major themes included motivating and inhibiting influences related to telerehabilitation and improvement suggestions. Participants liked the health benefits, access to care and social support. Participants highlighted a need for improved audio clarity and connectivity as well computer training for those with limited computer experience. The majority of participants preferred a combined face-to-face and online delivery model.
Conclusion: Participants in this study reported high visual clarity and ease-of-use, but provided suggestions for further improvements in group-based video telerehabilitation for HF.

Abbreviations: HF, heart failure; COPD, chronic obstructive pulmonary disease; NYHA, New York Heart Association functional classification; SD, standard deviation; TECH model, TElehealth in CHronic disease model.

Ethics approval: This project has received ethics (HREC/12/QPCH/86 and The University of Queensland 2013000796) and site-specific approvals at the Princess Alexandra Hospital (AU/3/FDD1118) and The Prince Charles Hospital (AU/3/3501113). All participants gave written informed consent before data collection began.

Trial registration: This trial was registered with the Australian and New Zealand Clinical Trials Registry (ACTRN12613000390785).

Source(s) of support: The primary author is a recipient of the Heart Foundation Health Professional Scholarship (ID: 100297).

Competing interests: The authors declare that there is no conflict of interest.

Guarantor and statement of contributorship: RH conceived and designed the study, collected and analyzed the data, and drafted the manuscript. All authors were consulted on the study design, edited and approved the manuscript. RP contributed to the data analysis.

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0147-9563/$ – see front matter
http://dx.doi.org/10.1016/j.hrtlng.2017.03.004

Introduction

As the number of patients with heart failure (HF) is predicted to grow with our aging population,[1] the ability to optimize service delivery in this patient group is vital. In a review of systematic reviews, there appears to be promising evidence of high patient satisfaction with telemedicine, including telerehabilitation across various patient groups.[2] Telerehabilitation is defined as the delivery of rehabilitation services at a distance via telecommunication technologies,[3] such as telephone, internet and videoconference. This emerging delivery model can potentially empower patients, promote confidence and deepen understanding of their condition, thereby leading to improved health outcomes.[2]

While there is some evidence to support the efficacy of telerehabilitation in improving exercise capacity and quality of life in patients with cardiac conditions,[4–6] little is known about patient experiences and perspectives for the HF group. Current literature on telerehabilitation in HF populations has mainly consisted of quantitative studies that report changes in clinical outcomes such as exercise capacity and health-related quality of life, rather than patient experiences and perspectives. However, there are a few studies exploring patient perspectives toward telerehabilitation in other patient groups. For instance patients with chronic obstructive pulmonary disease (COPD) reported that telerehabilitation provided via web-portal and videoconferencing led to health benefits, increased self-efficacy and motivation.[7–9] Similarly, patients with joint replacements highlighted the fact that they developed a strong therapeutic relationship with clinicians during the video-based telerehabilitation program.[10,11] Other studies also found that patients were generally satisfied with the video-based telerehabilitation program, but experienced some technological usability issues.[8,9,12] Despite these generally positive comments, the uptake of telerehabilitation into clinical practice remains slow. It is therefore important to better understand the experiences and perspectives of patients who have received this program delivery model so that services can be tailored to their needs.

Given the expansion of telerehabilitation services for people with HF, a need exists to develop a comprehensive understanding of patient perspectives and experiences with telerehabilitation by collecting both quantitative and qualitative data.[13,14] Using this approach, we will be able to converge and corroborate the two forms of data to bring greater insight into complex interventions such as telerehabilitation than would be obtained by either type of data separately.[15,16] Therefore, the aim of this mixed methods study was to explore patient experiences and perspectives related to a HF telerehabilitation program delivered into the homes via online videoconferencing.

Methods

Design

This study was part of a larger multi-centered trial investigating the effects of a HF telerehabilitation program conducted in tertiary hospitals in Queensland, Australia. In brief, the larger trial recruited patients with stable CHF, who were enrolled in a 12-week comprehensive HF disease management program. Participants were randomized either to a 12-week real-time video-based telerehabilitation program delivered twice-weekly, or a control group of traditional center-based HF rehabilitation program of the same duration and frequency.

Participants for this study were considered if they had attended at least two of the twenty-four available telerehabilitation sessions. Purposeful, maximum variation sampling was adopted. A convergent mixed methods design was used, where quantitative and qualitative data were collected in parallel, analyzed separately and then merged into an overall interpretation.[15,16] The study was approved by the Human Research Ethics Committees of participating hospitals and university, and included in the Australian Clinical Trials Registry (ACTRN12613000390785).

Participants

To ensure that we had a range of age, gender, experience with rehabilitation programs and using technology, the sample included at least two patients from each of the following categories: gender; age (under 60 years old, between 60 and 80 years and over 80 years); previous and no previous experience with center-based cardiac rehabilitation programs (to allow comparison between two different program delivery models); previous and no previous experience with computers; and previous and no previous experience with exercise. Patient experience with technology and exercise were self-reported. Patient characteristics such as age and confidence with technology have been suggested to have an impact on how telehealth can affect outcomes.[17] Participants were recruited concurrently with data analysis and recruitment continued until data saturation was reached.

Intervention

The telerehabilitation program in the randomized controlled trial consisted of a 12-week group-based exercise and education intervention delivered into the patient's home twice-weekly, using an online videoconferencing platform (Adobe Connect 9.2). The program is consistent with the TElehealth in CHronic disease (TECH) model,[17] that includes a focus on patient and clinician engagement and effective chronic disease management for facilitating the best chance of success for telehealth interventions. For instance, we implemented engagement strategies through information booklets, demonstration sessions and introductory letters. The project facilitated chronic disease management through self-monitoring and goal setting; actively delivering exercise-based rehabilitation; and fostering partnerships through regular communications with the primary healthcare providers and specialists. A videoconferencing approach enabled clinicians to observe the participants exercising in real-time; provide feedback and modification as required; and facilitate peer support. Educational topics were delivered as PowerPoint presentations with voice narrations. As listed in Table 1, topics included nutritional and physical activity counseling, in line with recommended core components of cardiac rehabilitation.[18] A 15-min interaction period was held at the start of each telerehabilitation session to facilitate group discussions of these educational topics.

Telerehabilitation equipment was loaned to the participants as required. Participants received a demonstration session, either in-person at the hospital or during a home visit, to become familiar with the equipment. An equipment information booklet with written and pictorial instructions was also supplied. Participants were guided to self-monitor and verbally report their vital signs at the beginning and end of each telerehabilitation session. Telephone contact details of the clinicians were included in the event that participants needed additional assistance or encountered technical difficulties. Safety strategies included exercise safety checklist, availability of a support person during the telerehabilitation session, and a protocol for managing adverse events.

Data collection

We collected quantitative and qualitative data via surveys and interviews respectively. More specifically, we collected the

Table 1
Telerehabilitation program content.

Program content	Description
Equipment	
Laptop computer	Inspiron 15, Dell Inc.
Mobile broadband device	E3131 modem, Huawei Technologies Co. Ltd.
3G wireless broadband Internet	Optus, Australia.
Automatic sphygmomanometer	Ri-champion N, Rudolf Riester GmbH.
Finger pulse oximeter	Digit 3420, BCI.
Free weights and resistance bands	
Exercise	Group-based aerobic and strength training.
Education	Topics included self-management, nutritional and physical activity counseling, medications and managing lifestyle and relationship.

quantitative data with self-reported surveys to determine the perceived usability of the technology and preferred program delivery model. The qualitative data were collected via semi-structured interviews to explore impressions of the telerehabilitation program, motivating and inhibiting influences, and suggestions for improvements.

Quantitative

A survey was developed with seven open-ended questions identified from the literature,[17,19] and from clinical and research experience. The survey used 10-cm visual analogue scales to collect participant responses on the audiovisual clarity; ease of use of computer and monitoring equipment; and general confidence with technology. There were also questions pertaining to the preferred program delivery model and suggestions for improvements. We pilot tested the survey and interview on two patients prior to study commencement and modified the survey according to this feedback. The surveys were posted to study participants after completing a 12-week telerehabilitation program.

Qualitative

Semi-structured interviews were conducted to solicit further information from the participants. The interviews were conducted between October 2013 and June 2015 by independent assessors not involved in the delivery of the telerehabilitation programs. Interviews were conducted face-to-face at the post-program assessment in a private hospital clinic room and the participant's support person could remain in the room upon the participant's request. The assessors were four hospital physiotherapists (with an average of 11.5 years of work experience in physiotherapy). The assessors used a standardized protocol for completing the interview. The interviews were audio-recorded and transcribed, and the transcripts de-identified.

During the interviews, participants were encouraged to speak freely about their experiences and perspectives of the telerehabilitation program. They reflected on the initial and subsequent impressions of the telerehabilitation program, motivating and inhibiting influences of the program, and suggestions for improvements. The questions based on an interview guide (Appendix A). Field notes were also undertaken to provide contextual details and record non-verbal expressions. Interview quotes were linked to replacement names to maintain patient confidentiality.

Demographic and clinical information were obtained from patient interviews, surveys and medical records, and included etiology, co-morbidities, New York Heart Association (NYHA) functional classification at post-program, socioeconomic status, center-based program experience, exercise and computer experience, and travel time to the hospital.

Data analysis

Statistical analysis of the quantitative data was performed using SPSS Statistics 22 (SPSS Inc., Chicago, IL). Descriptive analyses of clinical variables were computed. Data were checked for missing values, distribution and outliers; and presented as means (standard deviations [SD]) and counts (percentages) as appropriate.

Thematic analysis of the qualitative data was undertaken with the assistance of commercial software, NVivo version 11 (QSR International Pty Ltd, Melbourne, Australia). Thematic analysis has been advocated to explore patterns of perceptions that are anticipated as well as those that are generated from the data.[20] Surveys, audio and transcripts were imported into this software for data management and analysis preparation. The initial stage involved general inductive analysis, where the interview transcripts were repeatedly read and openly coded.[21] Coding was undertaken independently by experienced qualitative research coders with discussion between coders undertaken to reach consensus (if differences were identified). Bracketing was used to reduce coders' personal biases and preconceived ideas.[22] The codes were then used to construct a list of categories and the categories were grouped into themes.[23] The coding structure was revised and refined throughout the data interpretation process to reduce duplication, identify new categories and incorporate new themes and insights.[20] Approaches to assist with pattern recognition included hierarchical and axial coding which links themes with a commonality or causal relationship[24] and considers how themes relate to one another respectively.[25] Similarly, matrix coding queries[24] were utilized to determine the impact of age, gender and computer experience on telerehabilitation experience. Themes were presented as concept maps where possible and discussed with the investigator team to confirm concurrence of perception. These themes were then reviewed in relation to each original transcript and confirmed by other members of the investigator team. Member checking with all the participants and triangulation with the survey results were also used to ensure accuracy of interview interpretations. The rigor of the qualitative analysis was compared with the Consolidated Criteria for Reporting Qualitative Research (COREQ),[26] which is a 32-item checklist covering study design, analysis and findings.

Results

Flow of participants

A total of 17 participants were recruited to the study, at which point data saturation was achieved. No patients declined to participate in the interview. Of the participants, 88% were male, with a mean (SD) age of 69 (12) years. The mean (SD) travel time to the hospital was 30 (14) min and 41% of the participants had no computer experience. Table 2 summarizes participant characteristics. Interview durations ranged from 6 to 38 min, with a mean (SD) of 25 (10) min.

Quantitative

As shown in Fig. 1, the mean (SD) audio and visual clarity scores were 7 (2.8) and 9.1 (1.6) on a 10-point scale respectively; and ease of use of computer and monitoring equipment were 7.8 (3.1) and 9.3 (1.1) respectively. In terms of the preferred program delivery model, 29% of participants preferred online and 47% preferred a combined face-to-face and online approach.

Qualitative

Major themes derived from the interviews included the motivating and inhibiting influences of telerehabilitation (refer to Table 3) and suggestions for improvements.

Table 2
Demographics.

Patient characteristics	Total ($n = 17$)
Age (years), mean (SD)	69 (12)
Age group, *n* (%)	
< 60 years old	4 (24)
60–80 years old	11 (65)
> 80 years old	2 (12)
Men, *n* (%)	15 (88)
Ethnicity, *n* (%)	
Caucasian	15 (88)
Other	2 (12)
Etiology, *n* (%)	
Ischemic cardiomyopathy	11 (65)
Idiopathic cardiomyopathy	3 (18)
Heart failure with preserved ejection fraction, *n* (%)	3 (18)
LVEF (%), mean (SD)	34 (14)
Cardiac pacemakers or implantable cardiac defibrillators, *n* (%)	6 (35)
Co-morbidities, *n* (%)	
Atrial arrhythmia in past 5 years	8 (47)
Diabetes mellitus	10 (59)
COPD or asthma	2 (12)
Arthritis	3 (18)
NYHA, *n* (%)	
I	1 (6)
II	15 (88)
III	1 (6)
IV	0
Living situation, *n* (%)	
With family	16 (94)
With others	1 (6)
Occupation, *n* (%)	
Retired	8 (47)
Pension	7 (41)
Full-time employment	2 (12)
No computer experience, *n* (%)	7 (41)
No exercise experience, *n* (%)	4 (24)
Experience with center-based exercise programs, *n* (%)	5 (29)
Number of telerehabilitation sessions attended, mean (SD)	18 (6)
Travel time to hospital (min), mean (SD)	30 (14)

Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease; LVEF, left ventricular ejection fraction; *n*, number; NYHA, New York Heart Association scale; SD, standard deviation.

Motivating influences of telerehabilitation. Motivating influences for participating in the telerehabilitation program included improved health outcomes, access to care, and social support. The participants reported health outcomes such as increased strength, improved mood and balance, reduced symptoms, return to daily activities and fewer hospital readmissions. These health benefits were exemplified by Paul: *"I liked the program because I felt my health has improved … Before, let me tell you something, before I used to do 3 laps around the house and I would have to stop. Now I can do 10 laps and I don't feel tired"*.

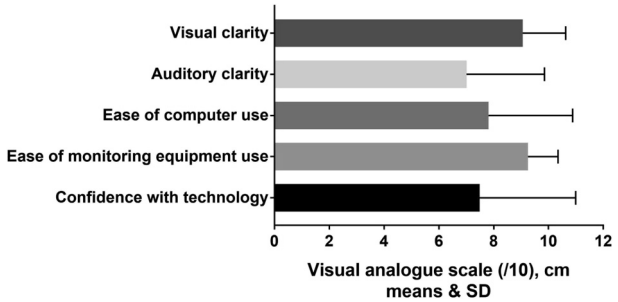

Fig. 1. Survey responses. The shaded bars represent the means and the error bars represent the standard deviations (SD) of responses.

Table 3
Themes from the interviews.

Major themes	Details of sub-themes
Motivating influences	
Improved health outcomes	Increased strength
	Improved mood
	Improved balance
	Return to daily activities
	Reduced hospital readmissions
Access to care	Reduced transport burden (reduced family burden, reduced travel time and increased convenience)
	Reduced transport cost (parking and public transport)
Social support	Family
	Other participants
	Clinicians
Safe	Supervised and structured
	Relaxed
	Timely exercise modification
Improved knowledge in heart failure self-management	Risk factor modification
	Regular exercise
Inhibiting influences	
Fear of the unknown	
Lack of prior computer experience	
Prior exercise concern	
Technical difficulties	Audiovisual issues and connectivity

A key motivating influence reported by all participants was the access to care with reduced transportation. More specifically, participants liked the program convenience, as there was no parking cost and travel time, and thereby lowered the family burden. Bob described that *"it was very positive (not having to come into hospital). The wife doesn't like me to drive anymore and it's a burden on her to drive in here all the time. It saves a lot of worry (not having to find a park at the hospital). And while I'm doing it at home, it frees her up to do something else"*.

Another motivating influence was receiving social support from the family, other participants and clinicians. Interestingly, participants reported spending more time with the family during the telerehabilitation sessions and the family also gaining health benefits from undertaking the same exercises. These unexpected benefits were highlighted by Craig: *"when [the family] saw me walking on the treadmill and doing some various exercises, it sort of threw them into thinking well maybe we should do some exercise too"*. Similarly, many participants appreciated the support from other participants, such as recipe swaps and well wishes from others when feeling too unwell to attend a session. Gary described that *"it was more relaxing (at home) …, because you are around your family and that's a support. We [the participants] had laughs and talked about the football. Even though I was younger, we all had that one thing in common and it didn't matter"*. This view was echoed by participants with culturally and linguistically diverse backgrounds. Mario responded that *"well it just showed we were all in communication doing it together, I wasn't doing it alone"*. Participants trusted the clinicians and felt supported during the program. This view was exemplified by Jim: *"I feel it gives you like you've got friends and you look up to [the clinician] because she's like a friend there doing this for you"*.

The participants also described the telerehabilitation program as easily accessible, safe and structured which facilitated program adherence. This ease of accessibility was illustrated by Don: *"you see the main thing is that [the clinician] up the front is showing you what to do, so you're trying to imitate it … So it is easy to sit there and get your arm in the right position"*. Interestingly, many participants also felt safe during the telerehabilitation program, as they were directly supervised in a relaxed home environment. For instance,

the remotely located physiotherapist could see as well as the co-located family member when participants were getting tired and modified the exercise accordingly. This supervision and a structured program facilitated program commitment and thereby promoted adherence. This view was summarized by Ray: *"the fact that somebody was watching me meant that the commitment had to be there to do it and you had to do it properly. And you also couldn't cheat cause [the clinician] was there saying that looks good, lift that arm a bit higher for example"*. Similarly, June explained that *"I liked the discipline of it. There were probably a few days where I would've stayed in bed for a bit longer. I also felt more competent in myself because you knew you had those two days of contact with [the physiotherapist] and with the cardiac nurse, so it was good to be able to talk things through and get a clearer picture"*.

A number of participants described improved knowledge in HF self-management and modified risk factors via dietary changes and reduced alcohol intake. This view was expressed by Gary: *"it's giving me a better understanding of the disease. I was put at ease as to how to cope with heart disease"*. Similarly John reported improved confidence: *"I was afraid to get out of the house (since the insertion of implantable cardiac defibrillator). I think this has probably helped the confidence … and I haven't been in hospital since [I] started the program, touch wood"*. Participants also highlighted that the program helped to establish regular routines for exercising. Fourteen participants (82%) reported that they had continued with the exercises since program completion. This continuation of exercise was outlined by Paul: *"If I don't continue, then all the benefits of the program will be lost"*.

Inhibiting influences of telerehabilitation. Although some participants were initially uncertain about what the program would entail and concerned about learning a new technology, they reported overwhelming positive feelings by the end of the program. Many participants had no initial idea about the program and reported a *"fear of the unknown"*, but were willing to *"give it a go"* and do *"anything to improve health"*. Some participants also reported feeling more confident about participating in the telerehabilitation program after experiencing it during the demonstration session and accessing the equipment information booklet.

Some of the challenges encountered during the telerehabilitation program were technical issues such as audiovisual clarities and connectivity difficulties. This is in agreement with the survey results which showed lower scores for auditory clarity when compared to visual clarity. In an extension of the survey results, a number of participants reported auditory fading, delay and feedback during the sessions. Ray described that: *"[the clinician] would fade in and out or if a plane would go over, which happened quite a lot, I would lose [the clinician] all together. Or if the weather was wet, the sound was hopeless. So there were quite a few things like that. Just the technical side of things"*. A few participants also experienced visual difficulties such as image freezing, image absence and small video window (secondary to the number of group participants). Although the participants encountered some technical issues like internet drop-outs and sub-optimal sound qualities, they remained committed to the program as they perceived that the health outcomes and convenience outweighed the technical issues. Don summarized: *"it might have frustrated you, but it didn't frustrate me"*. The participants adopted a range of strategies to overcome these technical issues. For example, they repeated conversations, talked in turns, relied on phone communications, followed the clinician's visual prompts and continued with the exercises independently while the clinician helped others in resolving technical issues. June explained that *"it was probably a little bit inconvenient that it dropped out a lot, but that wasn't a huge problem because after a couple of sessions you pretty much knew where the exercises were going while it was being reinstated. So it was easier"*.

Interestingly, there appears to be no difference between those with computer experience and those with no computer experience regarding the inhibiting influences of telerehabilitation. Both groups disliked the technical issues including audiovisual and connectivity difficulties. Those with no computer experience required more family and clinician support with accessing the telerehabilitation program to *"keep an eye out"* for the participant and *"be there for them"*. Interestingly, participants also reported that their families were happy to provide emotional support and technical assistance as they could see the health benefits. This view was expressed by Paul: *"my family is happy with the program like me. My wife is happy with me. She knew the telerehabilitation program was going to improve my health. My daughter is also happy, no problem"*. Some participants with no computer experience viewed this new skill acquisition as a positive challenge and one participant purchased a new laptop of the same model as the one used in the telerehabilitation program. As Bob said, *"The hardest part was the computers and that was the part I used to worry about most. I'll be 80 next birthday. But afterwards I enjoyed the fact that I was using it and I knew how to use one a bit. I skite amongst my mates about how good I am on a computer"*. Similarly gender and previous experience with center-based exercise also had no impact on the participants' perceptions of the inhibiting influences of telerehabilitation and program delivery models. However age seems to have an impact with older participants requiring more support to overcome the inhibiting influences of telerehabilitation.

Suggestions for improvements and advice for others. Consistent with the surveys, the participants recommended a range of strategies as illustrated in Fig. 2 to address the inhibiting and maximize the motivating influences of the telerehabilitation program. For instance, the participants suggested a demonstration session and ongoing practice to address fear of the unknown and computers. For participants with initial concerns about exercise, medical endorsement and education could also alleviate these concerns. As Jim explained, *"… (initially was concerned that I might) not be well enough to do this (telerehabilitation program), … there was one day I went back to the doctor and spoke about it and the doctor said just give it a go and just see how it goes so that's what we did and now we're very pleased"*. A number of the participants also highlighted a need for technical improvements including improved auditory clarity through the use of wireless headphones and the ability of the clinician to control the audio amplification of each participant; improved visual clarity through wide screens and highlighting the speaker; enhanced connectivity through the use of broadband internet; and computer training for those with limited computer experience. Another suggestion was the inclusion of trouble-shooting tips in the information booklet.

All participants supported the idea of extending the telerehabilitation program to people in rural and remote areas. As Joe summarized, *"it should be encouraged whether you are rural or local. Go for it, overcome any obstacles you may have with the technology and learning how to use it"*. Participants believed that telerehabilitation may be cheaper for the user than accessing center-based programs. Consistent with the survey results, the majority of participants preferred a mixed method where telerehabilitation sessions are combined with occasional in-person contacts. Interestingly, previous experience with center-based cardiac rehabilitation programs had no impact on preferred program delivery model. As Don advised potential participants, *"do it. It's the way of the future"*.

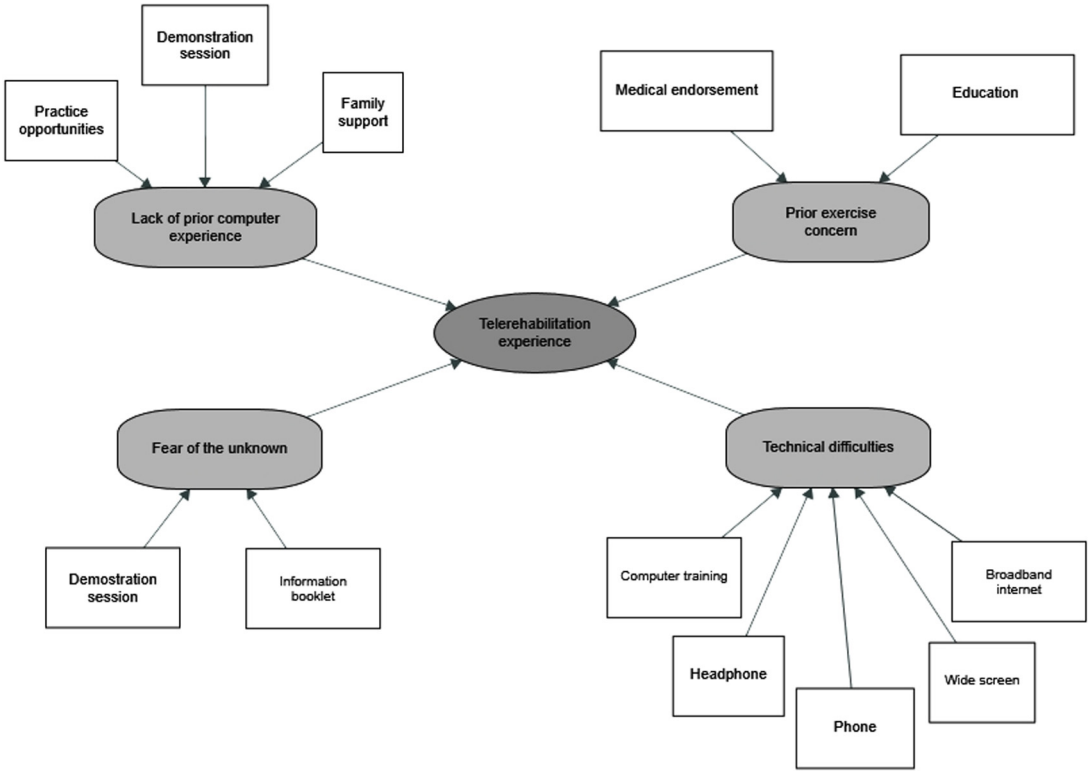

Fig. 2. Suggestions to address inhibiting influences of telerehabilitation. A shaded oval represents patient experiences with a heart failure telerehabilitation program. Shaded rectangles with rounded corners indicate the inhibiting influences of telerehabilitation. Clear rectangles represent suggestions to address inhibiting influences of telerehabilitation.

Discussion

Overall, participants in this HF telerehabilitation program reported positive experiences and perceptions with the program. A major contribution of our study was the discovery of various motivating influences of a telerehabilitation program, including health outcomes, access to care with reduced transportation, social support, safe exercise environment, and enhanced knowledge in HF self-management. A key motivator expressed by all participants was the easy access with reduced travel time. This is in agreement with other studies in patients with COPD, where telerehabilitation provided access to clinicians with specialized knowledge in the area.[8,9] Similarly in a qualitative study, patients with total knee arthroplasties described the elimination of travel as the predominate benefit of telerehabilitation.[10] Another strong motivating influence in our study was social support from the family, other participants and the clinicians. A group-based program was chosen for our study, as it has been suggested that many participants enjoy group interaction and social support from other participants.[9,27] This is in agreement with a study on community-based exercise program for people with chronic respiratory disease and HF, where many participants recognized that it was difficult to exercise independently and that they required the mutual encouragement of other participants and the physiotherapists.[28] Indeed, socialization and health outcomes are the frequently reported reasons to be physically active in the general elderly population,[29] and are also frequently reported in traditional center-based HF rehabilitation programs.[27,30] Participants in our study indicated health outcomes of telerehabilitation such as reduced symptoms and hospitalizations, as well as unexpected benefits from the social support like family connectedness and reduce isolation. Improved knowledge in HF self-management was also a motivator found in our study and this is consistent with previous telerehabilitation research in patients with COPD.[8] Our participants reported that the telerehabilitation program provided an appropriate level of supervision from a distance. This view is reflected in other studies, which also found that telerehabilitation provided a standardized, tailored and challenging exercise[10] and maintained closeness at a distance[11] in patients with joint replacements.

Inhibiting influences identified through the interviews were confirmed by the survey results, where there were lower scores for auditory clarity and ease of computer use. Despite these challenges, participants remained committed to the program as they perceived that the health outcomes and convenience outweighed the technical issues. This is in line with the *unified theory of acceptance and use of technology* model,[31] which suggests that performance expectancy (perceived usefulness of telerehabilitation) and effort expectancy (ease of use of computer and monitoring equipment) are the influencing factors on patients' acceptance of and compliance with telerehabilitation, and age and experience are the moderators. Similar to our study results, these authors argue that older patients and those with less experience tend to place greater importance on support and facilitating conditions when using a new technology.[31] Therefore more resources should be targeted at older patients and those with less experience when launching a new technology.

Our study participants utilized and recommended various strategies to overcome these inhibiting influences like accessing the demonstration session and information booklet, using phones as backup communications, connecting to broadband instead of wireless internet, and relying on family for computer support. These recommendations in combination with the motivating influences are consistent with the patient characteristics and effective chronic disease components of the TECH model. Some suggested strategies to maximize a successful telehealth implementation include facilitate confidence with technology, access fast

reliable internet, adopt simple inexpensive technology, promote self-monitoring, encourage active participation and regularly review patient progress.[17] Consistent with previous work,[8,10] most of our participants preferred to complement telerehabilitation with in-person visits.

Results of this study can help to inform the design of future telerehabilitation programs. For instance when planning for future telerehabilitation programs, it is important to maximize the motivating influences like sharing re-assessment findings with the patients to demonstrate a change in health outcomes and highlighting the benefits of telerehabilitation in providing an easily accessible program with a reduced transport burden. It is also important to implement strategies to overcome the inhibiting influences like accessing fast reliable internet and providing extra resources for older patients and those with less experience with technology. A better understanding of the motivating and inhibiting influences of a telerehabilitation program can help clinicians, researchers and industry partners to harness the motivating influences and combat the inhibiting influences, which in turn may maximize the future success of telerehabilitation programs.

Strengths and limitations

The current study has strengths including purposeful sampling; independent coders; and triangulation of the data. However there are some limitations. As the interviews were conducted in hospital, the participants may have been more reserved and less empowered than if they were interviewed in a familiar environment. We attempted to minimize this effect by using independent assessors not involved in the delivery of the telerehabilitation programs or in the direct clinical care of these participants. As all of the participants were recruited from the same city, it may be difficult to generalize the study findings. However we purposefully recruited patients with a range of patient characteristics to identify the impact of age, gender and computer and exercise experience. There was also an imbalance in gender distribution in line with a lower participation rate in rehabilitation programs for women.[27] While males predominate in the majority of published exercise-based rehabilitation studies in this population,[30] it is also commonly seen in clinical practice.[32] As our study focused on patient experiences and perspectives of a HF telerehabilitation program, future studies should explore other views including the patient's support person and clinicians involved in the delivery of telerehabilitation programs.

In summary, participants in this HF telerehabilitation program reported high visual clarity and ease-of-use, but provided suggestions for further improvements. Information on patient experiences and perceptions of telerehabilitation can help to facilitate future uptake and success of this delivery approach.

Acknowledgements

The authors would like to thank Gretta Palmer, Carly Turner, Sharyn Furze and Maureen Peasey for assistance with data collection and interview transcription; physiotherapy departments at participating hospitals for assistance with data collection; and the staff and patients of the heart failure services at participating hospitals for support with the study.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.hrtlng.2017.03.004.

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