Geriatric Nursing xx (2017) 1–5

Contents lists available at ScienceDirect

Geriatric Nursing

journal homepage: www.gnjournal.com

Research Paper

Evaluating the older adult experience of a web-based, tablet-delivered heart failure self-care program using gerontechnology principles

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ARTICLE INFO

Article history:
Received 27 December 2016
Received in revised form
28 March 2017
Accepted 3 April 2017
Available online xxx

Keywords:
Heart failure
Mobile devices
Health informatics
Self-care
Adherence
30-day readmission
Intervention
Remote monitoring

ABSTRACT

The goals of gerontechnology are to develop technology that facilitates goal attainment and improves satisfaction with life for older adults. Few mHealth technology systems have been evaluated using these criteria. The purpose of this paper was to present the qualitative analysis of participant post-intervention interviews from the tablet-delivered *Penn State Heart Assistant* intervention. Semi-structured interviews ($n = 12$) were conducted after the completion of a 30 day study protocol. Interviews were transcribed verbatim by a professional transcriptionist, then analyzed using an iterative process of coding, categorization, and thematic development using DeDoose software and a gerontechnology interpretive lens. Two themes with six *subthemes* arose: Benefits – *information sharing with others, usability and learnability, use of help resources;* Suggestions – *continuing use after the study, technical problems, participant suggested improvements.* Interviews suggested improved goal attainment and satisfaction with life for the older adults with use of the tablet.

Introduction

Geriatric nurses are increasingly confronted with both *patient use* of mHealth technology such as web portals and hand held devices as well as *patient feedback* on difficulties experienced with this technology. While the National Health and Aging Trends Study found that 40% of Medicare beneficiaries used e-mail or text messaging and almost 43% used the internet, many patients experience difficulties related to ease of use or familiarity with certain types of technology.[1] Gerontechnology brings together two separate fields of study – demography and technology – with the stated goal of developing technology that facilitates goal attainment and improves life satisfaction for older adults.[2] Using gerontechnology principles to develop new mHealth technology should result in fewer difficulties for older adults using new technology.

Over 5 million people in the United States have heart failure (HF), the majority of which are older adults.[3] Advances in mechanical circulatory support devices and treatment regimens continue to increase the likelihood that individuals who are hospitalized with HF will recover sufficiently to be discharged home.[4] However, more than 25% of these individuals will be re-hospitalized within 30 days[5] and 50% will be readmitted within the first six months after discharge.[4,6] Many of these unplanned readmissions are related to failures in self-care regimens at home.[6,7] mHealth technology offers new approaches to improve individuals' self-care through self-tracking and increasing patient empowerment in cost effective ways.[8] Our team is engaged in developing technology to improve self-care which hopefully will allow older adults with HF to be safely managed in the community.

Current HF technology studies have identified significant problems with effectiveness and broad implementation[9,10]

Conflict of Interest: none.
Funding: Department of Public Health Sciences and Department of Medicine, Penn State College of Medicine, Hershey, PA.
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http://dx.doi.org/10.1016/j.gerinurse.2017.04.001

suggesting the need for older adults to participate with technology designers earlier in the testing phase. However, to date, there has been relatively little report of participant feedback, on the technology itself, early in HF mHealth technology trials. When interviews have been conducted, participants have been asked about satisfaction with the technology or care delivery,[11,12] rather than being more broadly assessed to provide meaningful and specific feedback early in the development phase on their experience of the technology as currently designed and what changes they would like to see in the technology before future use. The purpose of this paper was to fill this gap by presenting the qualitative analysis of participant post-intervention interviews with older adults from the tablet-delivered *Penn State Heart Assistant* (PSHA) mHealth intervention using a gerontechnology interpretive lens. A gerontechnology interpretive lens involves the examination of the text for statements related to goal attainment or life satisfaction.

Method

Design

A proof of concept trial involving the PSHA was conducted with 12 older adults to assess participants' experience and response to the technology, as well as elicit suggestions for improvement. The quantitative data is reported elsewhere.[13] All participants were interviewed at the end of a 30 day trial with the PSHA.

Participants

Participants were recruited from a large, academic medical center in the mid-Atlantic region of the United States after Institutional Review Board approval of the protocol. Inclusion criteria: adults, alert and oriented, documented New York Heart Association class II–III HF in the electronic health record, currently hospitalized with a HF related admission, reliable home wireless internet access, English speaking and willing and able to participate. Exclusion criteria: children, chronic cognitive impairment documented in the electronic health record, dialysis patients, discharge disposition to a skilled facility, and New York Heart Association class IV or weight greater than 300 lbs (due to the exercise component). Screening was completed by a HF nurse practitioner (SB) and cardiologist (AF) on a daily basis over a three month period. Once deemed appropriate for the study, the HF nurse practitioner approached potential participants in the hospital one to two days before their expected discharge. The study was explained, tablet use demonstrated, and a brief introductory video was shown which outlined daily expectations for participants in the project. Potential participants were then consented if they expressed interest in participating and met inclusion criteria.

Intervention

The PSHA is a web-based, tablet delivered intervention, developed by our team, which encourages the participant to record their daily medication intake, weight and time spent with a brief exercise program using an aerobic stepper. Consented participants were contacted by trained research assistants (RAs) between 24 and 48 h after hospital discharge and an appointment was set up to deliver the PSHA tablet to their homes. The RAs reviewed a simple instruction manual, which included screenshots of the tablet, with the participants and then provided a phone number where they could be reached with any questions. Participants used the individualized tablet each day to record their information and to voluntarily view one short heart health educational video about HF causes and symptoms. After uploading the information to a secure server, the program created graphs that allowed the participant to visually track their information. The intervention lasted thirty days.

Data collection

The RAs received training from a qualitative expert on the study team (HB) prior to conducting the post-intervention interviews. A training manual was provided which included an opening script and a semi-structured interview guide. An example of a question in the interview guide was, "Did seeing your information change anything in what you thought about your heart or what you did in taking care of it?" If the participant answered "yes" the RA was instructed to follow up with, "What changed?"; if the participant answered "no" the RA was instructed to follow up with, "What would have helped you?" (see Supplemental material for full Interview Guide). Participants were interviewed at their earliest convenience (range 1–7 days) after completion of the protocol to assess their experiences with the technology including likes, dislikes, barriers to use, and suggestions for improvement. All interviews with audiorecorded with a digital recorder and then transcribed verbatim by a trained transcriptionist. The credibility of the study was enhanced by training in qualitative interview techniques by an expert, use of semi-structured interview guideline and field notes by the RAs, professional transcription and use of analysis tool, and analytic notes by the team during group analytic sessions. The 12 interviews ranged from 7.39 to 23.53 min per interview with an average interview lasting 14 min. There were a total of 168 min of interview data for analysis.

Data analysis

Interview transcripts were managed using Dedoose, a web-based qualitative analysis tool.[14] The general inductive approach outlined in Thomas[15] combined with the coding approach discussed in Saldana[16] was used initially to conduct the analysis of the interview transcripts. This resulted in five steps: 1) initial reading of text data; 2) identify specific text segments related to objectives; 3) label the segments of text to create categories; 4) reduce overlap and redundancy among the categories; 5) create a table incorporating most important categories.[15] Subsequently a gerontechnology lens was used in the interpretations of the findings; we carefully examined any text that suggested goal attainment or life satisfaction. Two team members (AP, EP) conducted the initial analysis which was then reviewed with further analysis by the full team. Any disagreement during the analytic process was resolved with iterative discussions and review of the literature. Trustworthiness of the findings are supported by the involvement of at least two team members at each stage of data analysis and use of an audit trail of process and analytic memos.

Results

The average participant was a 65 year old married, college educated male (Table 1). Six of the nine participants who provided information about their technical ability stated that they were familiar with the tablet or technically literate.

Analysis of the narratives resulted in two themes arising: theme 1: *Benefits from current use* which included the sub-themes – information sharing with others, usability and learnability, use of help resources; and theme 2: *Suggestions for future use* included the sub-themes – continuing use after the study, technical problems, participant suggested improvements.

Table 1
Demographic characteristics.

Age (in years)	67 (±13)
Gender (n = female)	5
Marital status (n)	
Married	8
Widowed	3
Single	1
Caregiver (n)	
Spouse	6
Other (friend, relative)	6
Race/ethnicity (%)	
White	100
Education (n)	
High school	5
College or graduate degree	7
Employment status (n)	
Retired	7
Employed	3
Disability	2

Theme 1: Benefits from current use

Information sharing with others

In total, there were eighteen coded instances of participants sharing their involvement in the program with outside individuals. Seven of the sharing episodes involved medical care providers; five involved family members; two involved others such as friends. Four participants did not share their involvement in the program. Family and other recipients of information sharing often provided positive feedback to the participant in response to finding out that they were on the program.

> *"I told them that I was involved in a program, a research study that my doctors were working together on. People would say that's nice … they were like, ok, that's kind of neat!"*

However, participants' health care providers were not always aware of the program and as a result did not offer much positive or negative feedback on the program.

> *"It perked the RNs' interest that I was participating in a program … she had not heard of it and asked me a little about it and jotted it down in my notes."*

This subtheme suggests that the PSHA has potential to improve older adults' information sharing. But it also presents a missed opportunity if that information sharing merely ends up as a note in the health record.

Usability and learnability

Participants who did not consider themselves technically skilled reported that they were able to easily and successfully use the tool after a short period of time.

> *"No, initially, [it was hard] as I am not as tech savvy, but after 2 or 3 days it was really easy …"*

Use of help resources

Six of the twelve participants reported using the PSHA instruction manual for help. Three of the twelve participants reported contacting the RAs by phone in order to get help. Three reported using both manual and phone. Two reported using the manual solely to find the RAs number. Overall, of those who used the manual, half used it every day while the rest used it for the first few days but then did not need it further. This suggests that the Help Resources provided with the tablet were sufficient to support the goal of the participant to enter and track their information.

Theme 2: Suggestions for future use

Continuing use

There were fourteen instances of participants expressing an opinion regarding continuing to use the tablet after the study was concluded. These participants could see the PSHA becoming part of their daily life and providing memory support related to their HF self-care. Overwhelmingly, twelve of the fourteen instances were positive.

> *"I think I would use it; I don't see why I wouldn't. As you get older, it's just a reminder that you don't forget some of the things."*

Two participants added that they took the information they learned from the study and adapted it to create their own recording program. These participants either used pencil and paper, or built their own "program" using software from other sources.

> *"I have an iPad and if the program were available, I'd use it every day in my own program. I still record my blood pressure, weight and exercise every day. So I instead of on paper, I would put it on my own iPad."*

Technical problems

Table 2 shows a summary of the technical problems with the number of reports in each category. Nine of the twelve participants reported experiencing at least one technical problem during the 30-day study. The most commonly occurring problems involved the navigation system and the built-in calendar in the application. However, there is evidence of willingness of the participants to work through technical difficulties or glitches in order to continue using the tool. In total, there were seventeen instances of work-arounds coded in the interview transcripts, representing six of the twelve participants.

> *"There was a glitch in the program that confused me at first, but then I just worked around it."*

One participant in particular experienced such a degree of technical difficulty that s/he discontinued using the application, but continued to participate by using paper and pencil to keep track of the information that the application would normally track.

> *"I think it would have been nice if it worked, but every time I went to log on it kept bringing up 'system error' or something like that and it was frustrating. I just put it back in the box and said, I'm gonna write things down and that will be good enough."*

In spite of this technical difficulty the participant still realized benefits from the program.

Table 2
Summary of technical problems.

Type of difficulty	Examples	Number of reports
Navigation glitches	Exit button would not work On-screen navigation sent users to the wrong screens	4
Calendar	Calendar day did not match with the actual day Calendar did not show up on screen Calendar steps did not connect	3
Authentication	Would not allow user to log-in to the system	2
Non-responsive buttons	Buttons or entry fields were non-responsive	2
Timer	Timer would not work	2
Weight	Weight screens did not match correctly	2
Connection error	Could not connect to the server	1

"… but just writing things down helped me to watch my weight."

Technical problems, even when worked around, in all likelihood do not improve either goal attainment or satisfaction with life for older adults. As such there is need to address any technical problems as early as possible so that participants can benefit from rather than battle with the technology.

Participant suggested improvements

Table 3 shows suggested improvements with the description of each category and number of suggestions in each category. Participants had a total of 38 suggested improvements, spanning eleven different categories. The most frequently mentioned improvements related to lifestyle (adding a diet/nutritional tracking feature) or improving usability (ability to edit entries or make multiple entries in one day). One participant suggested that there be a tutorial at the beginning of the program for those who are not familiar with the tablet or how to use an application.

"You might in the very beginning have a crash course for the older people who are not familiar with it all."

Discussion/conclusion

The purpose of this paper was to present the qualitative analysis of the *Penn State Heart Assistant* post-intervention interviews. Overall, the responses indicate that the older adults in our study viewed the mHealth technology positively suggesting that it was helping them achieve their goals and improve life satisfaction. Additionally, they offered a variety of meaningful insights into the benefits of using the technology and made significant suggestions for future versions of the application.

Participants who shared information about their involvement in the program realized mixed results. This would seem to indicate that participants should be encouraged to share their involvement with mHealth technology with family and other close individuals, because the feedback can serve as positive reinforcement of technology use and goal attainment. This positive reinforcement could act as another way to improve self-care and limit self-care failures after hospital discharge through improving self-efficacy, a known determinant of successful self-care.[17] The development of mastery is a key feature of self-efficacy.[18] Sharing information allows the participant to share their growing mastery in self-care and reinforces perceived mastery for the participant. But the data also shows that the participants' health care team, including nurses, needs to be part of or at least aware of the program. A recent technology clinical trial, the BEAT-HF intervention, similarly cited lack of care team engagement as a possible cause for their null findings.[10] Prior research has shown that clinicians are interested in engaging with patient generated data,[19] and that patient generated data has value in the treatment of diseases.[20] The major challenge of engaging the team is fitting the mHealth technology in with the clinical workflow and individual needs of the clinicians. Creating teams that include clinicians, health systems engineers, and information technology professionals to create and test possible solutions is needed.

As is common in early studies, the PSHA had some technical difficulties that need to be rectified before it is scaled up. However, in this sample of 12 older adults over a 30 day period (360 use days) participants only reported 16 instances of glitches (.04%). Participants who ran into glitches or other technical problems demonstrated a high level of resiliency in figuring out what went wrong or working their way around it. This suggests that participants are willing to deal with some technical difficulties, which can be expected in rolling out a new technology-based program. This bodes well for introducing the program to a larger population, as participants are unlikely to give up at the first sign of difficulty.

The information presented in this paper has certain limitations that should be kept in mind. First, this is a very small, homogeneous sample recruited from one academic medical center. However, our

Table 3
Summary of suggested improvements.

Suggested improvement category	Description of category	Number of suggestions	Example
Nutrition/eating	A diet tracker and nutritional information database.	10	"They need to address the diet that you should be on." "There is nowhere in the program to track or tell you about sodium content."
Editing daily entries	The ability to go back and edit entries, or do multiple entries in a single day.	8	"Step #1 is that you've taken everything and I haven't, I haven't taken $^1/_2$ of what I'm supposed to be taking, but I put down that I did."
Comment/chat sections	A comment or chat section to explain changes in weight or other discrepancies that might otherwise cause alarm.	3	"Or just put a comment [section] in so that they are aware of why the weight went up the way it did." "To have a button they could press and record a message that would go right to you and then you could respond right back."
Other medical measurements	Ability to track other measurements (i.e. blood pressure).	3	"It didn't collect my blood pressure data." "You see all the things I monitor, my pulse rate, my oxygen saturation, blood pressure, glucose, weight."
Reminder/alarms	Alarms or reminders to complete the daily activities.	3	"I think it should have timers on it."
Fitness tracker	A fitness/exercise programmer and tracker.	2	"If I could add my gym workout in there that would be great." "You measure the length of time on the exercise but not the number of steps."
Instructional materials	Improvements to the hotline or manual.	2	"You might in the very beginning have a crash course for older people who are not familiar with it at all."
Navigation	Improvements to the application's navigation.	2	"It's just the routing through them that could be simplified."
Editing medicine	The ability to change what medicines appears on the program.	1	"I did want to mention that on the first screen, where you are putting in all of the medicines, I did see the doctor and she did add medicine and there was nowhere to recognize that."
Graphical user interface (GUI)	Standardization of GUI	1	"Each of the screens did not have a completely uniform GUI."

sample is comparable with many current HF clinical trial samples suggesting the transferability of our findings to other like populations. Secondly, our decision to require home wireless internet access more than likely resulted in a more computer literate sample than currently found in the general population.

This intervention and study are important for both geriatric nurses and their older adult patients. This study shows that the PSHA is feasible to use with community based older adults after discharge from the hospital. This study suggests that engaging older adults earlier in the design phase of a new mHealth technology trial and then evaluating their responses using a gerontechnology lens may result in an improved user experience and hopefully improved health. We recommend that future studies examine the potential health benefits that patients' receive and financial benefits that health care systems may realize from this type of mHealth technology.

Acknowledgements

The team acknowledges the instrument help provided by Eric Balaban, BS, John Chan, BS, Penn State medical students, as research assistants and interventionists on this project.

Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.gerinurse.2017.04.001.

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