

Developing Health Technologies for Older Adults: Methodological and Ethical Considerations

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ABSTRACT

Developing technologies for older adults is a growing area of research. We have designed and evaluated a tablet-based mobile application, *seniorHealth*, for low-income older adults residing in independent living facilities. Challenges, such as participants' inexperience with technology, made it difficult to apply user-centered design (UCD) philosophy in developing *seniorHealth*. Participants' difficulties in learning tablet skills raise ethical concerns around creating a technology-based solution the target population. Support groups, community connections and better understanding of older adults psychology may hold solutions to these ethical dilemmas, and should be explored further in defining a roadmap for implementing technology-based solutions for older adults.

CCS Concepts

• Human-centered computing → Human computer interaction (HCI) → HCI design and evaluation methods. • Human-centered computing → Interaction design → Interaction design process and methods → User-centered design.

Keywords

Older Adults; Tablets; Health; Pilot Studies; Independent Living Facilities; Sustainable Technologies; Low-Income; Quality of Life; Successful Aging; Ethical; Methodological

1. INTRODUCTION

As people are living longer and population of older adults is increasing [4], interest in designing health technologies for older adults is also on the rise. In particular, attention is being paid towards developing technologies that can improve older adults'

quality of life to help them avoid health-related problems and stay out of the hospitals for as long as possible. Designing technology for older adults is a challenging task, and is related to older adults' limitations associated with age-related physical and cognitive decline, and feelings of vulnerability.

Researchers recommend that technology for older adults should be designed according to users' needs, wants and limitations [2, 3, 5]. It is expected to involve older adults in every stage of technology design and development, so they can influence the evolution of technology in their favor. However, this guidance around involving older adults is not clear and often raises methodological and ethical concerns.

In this paper, we describe challenges and concerns encountered during our research with older adults. We discuss our workarounds and make further suggestions.

2. CONTEXT

For over four years, we have partnered with an Aging in Place (AiP) program of a local hospital to design and evaluate a pervasive health project. The goal was to improve quality of life and promote successful aging in low-income older adults residing in independent living facilities. The project consisted of a tablet-based mobile application, *seniorHealth* for older adults, and a web-based portal for AiP staff. Participants tracked and managed personal health data with the application and also received feedback. AiP staff visualized participants' data on their portal and provided health oversight through a module that delivered messages to participants' tablets.

Table 1 *seniorHealth* Evaluation

	Pilot 1	Pilot 2	Pilot 3
Participants	n=16	n=37	n=34
Duration	Oct '13 – April '14	Jan '15 – July '15	Jan '16 – Now

The main features of *seniorHealth* were suggested by AiP staff, and incrementally evaluated in three pilot studies, Table 1. Numerous feedback sessions with study participants were held during each pilot to improve these features and ensure a user-

centered design (UCD). We have also conducted focus groups and interviews to understand target population's health needs and adaptive strategies.

3. PARTICIPANTS

We have worked with a total of 40 unique participants with an average age of 66 years ($SD=9.2$). Fifteen participants were females and remaining were males. Thirty-six participants identified themselves as African American/ Black, three as non-Hispanic whites, and one as other. One participant was married and lived with her partner. The remaining participants were divorced/ widowed/ separated/ single and lived alone. Six participants had less than eight years of education, thirteen had completed high school, sixteen had 1-2 years of vocational school, three were college graduates and one had an advanced degree. Thirty-four participants reported having at least one chronic condition. All participants were low-income. According to living facility rules, only individuals with income at or below \$25,380 could stay in the building (\$28,980 for two and so on).

4. CHALLENGES & SOLUTIONS

Based on our studies and extensive interactions with the study participants, we describe challenges we faced during design, development and deployment of *seniorHealth*. We discuss possible solutions to address these concerns.

4.1 Design

Research recommends UCD approach for developing technologies for older adults [1]. UCD philosophy considers target user's needs, wants and limitations at every stage of product design and development. While focus groups and one-on-one interviews helped us identify target population's needs, our approach towards designing solutions for those needs was a bit complex. The study participants were technology novices and lacked vision about technology's capabilities. This limited them in suggesting technology-based solutions that could address their health needs. Consequently, the design solutions were developed in consultation with researchers and AiP staff members, and then refined through iterative participant feedback.

We evaluated our proposed solutions with high-fidelity prototypes rather than low-fidelity versions. This is because, due to their unfamiliarity with technologies, paper-based prototypes could not help participants visualize the mechanics of technology and understand solutions to their health problems. Therefore, we could only elicit participants' feedback on *seniorHealth* after they had they actually mastered and used a high-fidelity version. This approach restricted participants to solutions that were made by the researchers and AiP staff. Participants' feedback indicated that they were satisfied with *seniorHealth*, but this feedback may not have been completely honest. It is well known that older adults tend to be conforming [6], and do not want to say something to make someone unhappy. Implementing a high-fidelity version also lengthened the research time that had budgetary constraints, and forced us to make a lot of assumptions about the target users.

UCD demands that product design should adapt to users' needs and wants, instead of forcing the user to change their attitudes and behaviors to learn and use the product. We could not achieve that level of objectivity with the target population. This is because most participants had never used a tablet or a smartphone prior to the study. And we made a lot of design decision based on the limitations of tablet. We provided needed support to help participants learn basic tablet skills by organizing technology workshops. Even then, tablet adoption was a frustrating and

challenging experience for many participants. In the end, participants had to change their attitudes and habits to adopt technology in their lives.

4.2 Learning Curve

Participants faced a lot of difficulties in learning the new technology. Using the touch screen was difficult for the majority. Participants struggled using the pad of the finger to use the keyboard and click icons. Tablet's screen was also overly sensitive to touch that often led to unintended interactions confusing the participants. As a result, execution of technology workshop was usually unexpected in nature. Troubleshooting participants' immediate problems usually took precedence over teaching topics originally planned for the workshop. We had to demonstrate high level of flexibility to avoid participant discouragement and disengagement.

Teaching older adults requires a lot of patience. Repetition is the key. We reiterated workshop content until participants felt confident about their ability to use the tablet. Most participants were self-directed and needed one-on-one help to learn any skill. This was an issue during the first pilot study when only two facilitators were present per workshop making it difficult to provide needed help and attention to participants. We addressed this concern in our later pilot studies by soliciting help from technology students of a local high school. The students conducted technology workshops, and provided one-on-one mentoring to participants. Ultimately, participants' persistence, and our continuous and need-based support helped participants master the tablet.

4.3 Social Support

To counter participant disengagement and solicit their feedback, we organized numerous feedback sessions during each pilot study. These sessions and technology workshops became very popular among participants who utilized them to increase their interpersonal interactions. Participants, who were intimidated by the tablet and wanted to discontinue to the study, found mentors among their peers who helped them resolve their tablet issues and regain motivation to stay in the study. For others, it was an opportunity to demonstrate the skills they had learned in the workshops.

Outside these organized events, participants who were considering dropping out of the study, mainly due to the poor Internet connectivity in their apartments, took the initiative to come out to the community room where they experienced better WIFI signal. The community room social setting also provided them the opportunity to socialize with other study participants and exchange ideas and information about the tablet. During this time, other residents of the living facility found what their peers were learning, and became interested in joining the study.

4.4 Knowing the User

Frequently, participants encountered life events such as opportunity to earn extra cash, attend doctor's appointment, family commitments that took precedence over their commitment towards their involvement in the study. As a result, it was often difficult for them to attend workshops and feedback sessions.

It was common for participants to become disengaged and distracted during training. As a result, working with older adults required considerable patience. Older adults were very curious and asked a lot of questions. We had to demonstrate empathy towards participants for which we may have been under-prepared.

As suggested by prior research [5], we incrementally released features of *seniorHealth* instead of releasing them altogether [5]. This allowed us to separately evaluate each feature, and also enabled participants to get used to the application. Whenever participants' application was updated, they had to complete new assessments. This caused inconvenience and frustration among participants.

4.5 Sustainability

During the pilot study, participants received continuous support and care. We wanted to make sure we do not lose anyone along the way therefore, we were careful to listen to them and incorporate their feedback in every iteration of the application. In general, participants were satisfied with the application and "*Excellent program I hope it continues for other people in the community. Thank you*" (Pilot 1, Participant 10). However, once the study ended, the support network also ended, and participants raised ethical concerns about the discontinuation of support and execution of the study. "*I feel as if I wasted my time and efforts. This was to be about and for seniors, ... I have been alive awhile now and realize that others have their own agendas. I was expected to do all that was asked of me but was not given the same respect. ... Every human needs to be valued not just used!!!!*" (Pilot 1, Participant 2)

Participants were allowed to keep the study tablets with themselves at the conclusion of the study. However, as researchers' support was no longer available, possession of a tablet might not have been helpful. Moreover, several participants had run out of space on their tablets soon after the study ended – a problem they did not know how to address on their own.

5. CONCLUSION & FUTURE DIRECTION

Methodological and ethical challenges in designing, developing and deploying technology-based solutions for older adults relate to decline in their physical and cognitive health, and their inexperience with technologies. We recommend that technologies should be designed to be sustainable. Researchers should seek community partnerships that can continue to provide technical and health-related support to older adults beyond research. With suitable training, high school students become excellent technology mentors for older adults. Medical schools should consider instituting similar community partnerships for their

gerontology students. Finally, incentives and support mechanisms should be set up for older adults who emerge as leaders and mentors during the research, if they want to continue influencing their peers beyond the study.

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