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Older adults' acceptance of a community-based telehealth wellness system

George Demiris, **Hilaire Thompson**, **Jaime Boquet**, **Thai Le**, **Shomir Chaudhuri**, and **Jane Chung**
University of Washington, Seattle, WA, USA

Abstract

The development of ongoing assessment tools to monitor older adult health and wellness can support improved quality of life and independence. These technologies have often been employed within private residences. Our work describes a telehealth kiosk system implemented within a community setting, which reduces the costs of installing and maintaining individual systems. Though user acceptance of telehealth systems has been studied within the context of home residences, this has yet to be addressed for community-based systems. Older adults in a retirement community were recruited to use a telehealth system including assessment of vital signs and cognitive performance. With a series of focus groups (N = 12, average age 79.3 years), we examined user perceptions of the telehealth kiosk, addressing issues of usability, effectiveness and privacy. Older adults were favorable towards the collection of health monitoring information, recognizing the utility of these data sources. There were issues of usability, especially regarding ergonomics of the telehealth kiosk. We found no concerns over privacy, with some participants expressing increased preference for the social interactions afforded through the community setting. Understanding the social, technical and human factors involved with a community-based telehealth system can inform the design of cost-effective health monitoring systems.

Keywords

Telehealth; older adults; wellness; community health

Introduction

The rise in the aging population of the United States has led to an increase in awareness and focus on older adults' health. Although many research studies have addressed the role of chronic disease management, special attention also needs to be given to the role of quality of life and independence for older adults [1]. According to Dunn [2], maintaining overall wellness can actually slow the progression and even potentially prevent the deterioration of functionality that is caused by chronic disease. Expanding upon this idea, Hoyman [3]

Correspondence: George Demiris PhD, University of Washington, BNHS Box 357266, Seattle, WA 98195, USA. gdemiris@uw.edu.

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emphasized the need to address the multiple dimensions of wellness: (1) physical well-being/fitness; (2) mental and cognitive health; (3) social well-being; and (4) spiritual well-being. To help older adults remain independent, we must maximize wellness. Through careful monitoring, deteriorating health conditions can be identified early, such as a change in one's activity levels or ability to carry out activities of daily living independently. Early identification of such problems can lead to mitigating, reversing or preventing adverse events that impact overall quality of life. Physiological parameters including vital signs are basic health status indicators; further, functional independence in mobility and self-care is essential for activities of daily living. The cognitive faculties that prompt and guide our activities are equally important in preserving independence. Mental health is an essential component as studies have shown that depression is common in older adults [4]. Social parameters of well-being are critical in the older adult population. Social isolation is more prevalent in older adults because of their diminished vitality and health [5]. The behavioral and physiological mechanisms by which social relations affect the health of older persons are well documented [6]; inadequate social support and perceived or real social isolation are stressors found to have effects on immune, metabolic and cardiovascular systems as well as health-related behaviors [7]. Thus, optimal tools for measuring and interpreting wellness in older adults should capture all parameters described by Hoyman and Dunn's theories [1].

An ongoing assessment of all underlying methods of wellness over time can be challenging given the cost of health services and workforce shortage. Traditional methods of capturing wellness parameters may require physical interaction between clinician and patient; however, several studies suggest that telehealth may be just as effective in achieving successful measurements and outcomes. For example, Dang et al. [8] utilized a telehealth program called T-Care to monitor physiological parameters via an in-home messaging device called the Health Buddy. The messaging device also educated patients, providing tips, reminders, and asked questions pertaining to diabetes and cardiac disease management. They found that after two years of the T-Care intervention, there were significant reductions in systolic and diastolic blood pressure readings and in overall coronary heart disease risk. An additional study by Barnason et al. [9] examined whether a telehealth intervention, also utilizing the Health Buddy, would improve outcomes after coronary artery bypass surgery. The telehealth intervention utilized in this study focused on physical activity, exercise, symptom monitoring, self-efficacy and symptom management and demonstrated significant benefits. Telehealth therefore has the potential to provide a platform for the assessment of multiple parameters and to support the management of complex health states. Specific to care of older adults, several telehealth systems have been developed and evaluated for use by elders in their home [9–13]. This individualized approach has increased hardware costs as each user needs to have equipment installed in their home for personal use. An alternative model for community dwelling older adults is the use of technology in community settings (such as community centers, neighborhood clinics, libraries) that can be used by multiple users.

Emerging IT tools often fail to include or specifically address older adults as potential end users and to recognize their information needs and issues of acceptance and usability in the context of aging. Older adults may benefit however most from such tools, as they are often in transition between different healthcare settings and therefore, vulnerable to receiving

fragmented care services [14]. Healthcare delivery for older adults is divided into discrete loci of care that often function in isolation of one another. Financial and regulatory barriers further reinforce these silos of care [15], leading to greater use of hospital and emergency services, increasing healthcare costs [16]. Older adults and their families are called upon to play an active role in health-related decision making often without appropriate tools to facilitate access to information, synthesis of information from multiple sources and longitudinal, accurate and easy–to-interpret datasets

When discussing the use of advanced technology to monitor older adults, privacy considerations play a major role. However, the use of monitoring technologies in community settings has not been studied extensively when it comes to potential privacy concerns. Most studies have examined privacy considerations in the context of technology use within individual residences. In a focus group study by Coughlin et al. [17], older adult participants commented on the potential use of advanced technologies to monitor elders in their home, and all raised concerns about the amount of personal information that would be collected and who would both manage and have access to these data sets. Similarly, Dorsten et al. [18] conducted focus groups with older adults in long-term care settings as well as other stakeholders (family members, healthcare providers) and concluded that while all stakeholders were receptive to emerging technologies that can improve quality of life and care, the design and implementation of such technologies must satisfactorily address ethical issues such as privacy and trust. This finding was echoed by a study of technology acceptance among older adults by Kang et al. [19], where older study participants reported their willingness to trade privacy for oversight by technology if it enabled them to remain independent. Limited work has been conducted regarding potential privacy concerns resulting from operating technologies in common areas or using multi-user hardware. Bellotti and Sellen [20] define privacy as a personal notion shaped by culturally determined expectations and perceptions about the surrounding environment. Within their framework, the following parameters play a role in privacy perceptions, namely: capture (when and what information gets recorded), construction (what happens to the information once it gets recorded), accessibility (who has access to the information) and purposes (how will the information be used) all define privacy perceptions. Therefore, the fact that capture occurs in a publicly accessible setting may influence privacy considerations differently than in cases where capture takes place within one’s own home.

Human factors also play a significant role in the successful implementation of a telehealth system regardless of the setting and involve the study of the user experience and the systematic effort to maximize ‘the positive elements of telehealth system design, implementation, and operation’ [21]. The typical end user for telehealth systems will likely be older and, in some cases, may have reduced cognitive, perceptual and psychomotor capabilities [22]. Thus, user acceptance among older adults is greatly affecting successful implementation and diffusion of technology solutions for healthcare monitoring.

Purpose

The purpose of this study is to evaluate the perceived usability and effectiveness of a telehealth wellness kiosk in an independent retirement community as well as privacy

considerations. The study aims to provide further insight into the challenges and benefits of a telehealth kiosk when utilized by community-dwelling older adults.

Methods

To understand interactions of older adults with a telehealth wellness system and their perceptions, we conducted focus groups with older adults who were already participating in a larger telehealth project in an independent retirement community in Seattle, Washington. The facility consists of 146 private apartment homes for persons 62 and older and a dedicated room within the facility was provided to the team for study purposes. This project utilized a multi-user telehealth kiosk that allowed assessment of physiological parameters (blood pressure, weight, pulse oximetry, blood glucose), online questionnaires, a library of educational videos and a brain fitness web-based software solution. Each user had their personal card they inserted when they wanted to use the telehealth kiosk. This card served as identification that allowed users to access their own personal health information over time. Participants had the option to leave their card with study staff who were in the community room and could provide them with their card so they would not have to worry about losing or misplacing their card. Participants used the brain fitness software three times a week and the remaining kiosk features at least once a week. They received monthly printouts of all their wellness assessment data (these printouts included all assessments for the month in numeric and graphic form). If participants had any questions about their data, they could either contact our research study nurse to discuss or bring a copy of their printout to their own healthcare provider. The larger study is described in detail elsewhere [23]. Subjects were recruited in the study if they were 65 years or older, residents of the participating facility, able to speak and write English, independent in activities of daily living, ambulatory (but may use assistive devices), cognitively able to provide informed consent and with adequate visual acuity to read a computer screen.

Subjects were recruited to participate in focus group sessions to evaluate the usefulness and challenges with a telehealth wellness system which was implemented in a community room within the participating retirement community. The focus group protocol included questions about overall perceived usefulness of the system, ease of use, privacy concerns and overall attitudes towards community-based monitoring systems (Table I). The sessions were audio-taped and transcribed verbatim for further analysis. Two coders reviewed an initial set of transcripts and developed an initial coding scheme. Each member of the coding team independently performed a content analysis of the remaining transcripts using a data-driven coding approach. Data were combined and discussed until consensus on themes and coding was reached. Data were then analyzed by emergent themes, by item and by non-emergent themes.

All study procedures were approved by the University of Washington Human Subjects Division Institutional Review Board.

Results

We conducted two focus group sessions with a total of 12 subjects (six in each group). The average age of focus group participants was 79.3 years. Eight subjects were female and four male. The first session lasted 47 min and the second session almost 1 h. Responses were grouped in the following thematic categories.

Purpose

When subjects discussed the vital sign assessment aspect of the wellness kiosk, all subjects agreed that they appreciated the ability to frequently capture physiological parameters and be made aware of their physiological well-being. Two subjects stated that the blood pressure readings were higher than any of their usual readings, and used the opportunity to discuss the findings further with their providers. In terms of usefulness, subjects who already engaged in self-assessment of vital signs in their own home did not see added value of the kiosk: six subjects stated that they were already assessing their blood pressure regularly. All twelve subjects found the cognitive assessment (brain fitness) software very useful. As one subject stated, ‘Making sure you know where you are with the mind, the cognition, is reassuring’. Finally, when it came to assessment of social interactions using a self-reported social support questionnaire, participants felt it was important to monitor that on an ongoing basis to prevent isolation and loneliness, but were mixed in their perceptions of usefulness of assessing spirituality using a self-reported spirituality questionnaire (with 65% of the participants finding little or no value in that information).

Usability

In terms of usability issues, several participants identified one or more challenging circumstances. Four subjects also identified challenges with the kiosk not always registering their weight or oxygen. Two subjects also described frustration when trying to understand their displayed results, and felt that the results of the vital sign measurements would be much more meaningful if provided with some interpretation (both for the displays on screen as well as the monthly printouts). Five subjects stated that they needed assistance when trying to capture vital signs. An additional issue identified was that the kiosk displayed data on the screen data using non-standard scales which were too dramatic, specifically for weight, making small changes appear large.

Subjects identified usability challenges with both the hardware and the software involved in the cognitive assessment. Six subjects discussed severe frustrations with the computer mouse, and two of the subjects experienced significant difficulty due to arthritis in their hands, when trying to manipulate the mouse correctly. With regards to the software, one subject stated, ‘Sometimes it wasn’t clear just what they expect of you’. Another subject stated, ‘I think the [cognitive assessment] program itself is interesting, but has a lot of glitches in it. Just in the program itself. It is a good concept. Just the mechanics of it’. The audio component of the software also presented a challenge for some subjects with hearing aids. One subject stated that usually the ability to read lips assists with hearing challenges; however, this was not an option when using the software, and there was a lack of context for interpretation. The software provided a choice of no-audio with written instructions on the

screen or a combination of audio and text instructions, but the subject felt it was hard to recall these choices once the exercises had started. Overall, the subjects articulated that they would use the system consistently if it had a better mouse, interface and images they are more familiar with. Several of the cognitive assessment questions asked the subjects to identify objects; however, the word and/or object was not typical for the subjects' geographic area of residence, and thus created some confusion and frustration. Several subjects proposed that it would be beneficial to have an option to skip and/or restart the cognitive assessment exercises. One subject stated, 'I left sometimes with a rather frustrated feeling'.

Feedback

When asked about the usefulness of printouts, the majority of subjects believed these were very useful and allowed them to share data with family and their clinicians. Specifically, they saw value in health-related decision making ultimately envisioning a telehealth kiosk as a tool that can enhance their independence and control over their health status. Almost all subjects expressed very little interest in the educational videos focusing on aging-related topics (e.g. nutrition, arthritis, mobility) and stated that they prefer to get their healthcare information from the internet, their healthcare provider or clinical textbooks rather than a community kiosk.

Additional recommendations for improvement made by subjects included embedding recommendations or action items in the monthly printouts summarizing data, stating that monthly printouts were actually preferred over entering a portal or web site to retrieve this information. Some users also stated they would like more feedback, including diagnostics and recommendations, and that feedback 'along the way' would help them determine if they are doing better or worse.

Setting

Overall, the telehealth wellness kiosk was perceived as useful by the majority of the subjects in the focus groups. The subjects stated that they prefer the community setting when utilizing the kiosk, and that this provided fewer distractions than their homes. They also expressed favor for the community setting within their living facility over a public setting such as a wellness center or pharmacy. Several users also stated that it would be necessary to have staff on site to assist with utilizing the wellness kiosk.

Privacy

None of the participants expressed any privacy concerns when using the telehealth kiosk. When asked specifically about capturing vital signs or entering health-related information using a kiosk within a community room that is accessible to their neighbors, subjects felt that they had no concerns. One participant stated, 'This [kiosk] was in the corner, it was very private, I did not mind people coming in and going…'. When asked about monthly printouts of their regular assessments that were delivered to the residents, one participant questioned the need for privacy assurances stating 'Why use a [sealed] envelope? This privacy thing is more important to you (research team member)'. Several participants expressed that not only did they not have privacy concerns using the telehealth system in a community room, but

rather they stated their appreciation for the social interactions that this set-up provided. As one participant pointed out, 'It was nice to see others here, sometimes I was here by myself, but when others were here, it was more fun'. Several participants emphasized the social benefits of a community system that brings people together. Three participants even commented that they wanted to be able to share data among participants. As one person stated, 'It would be good to see how well one is doing compared to the others here (in the community) and whether one is doing better or worse than average'.

Discussion

Several of the subjects' experiences with the wellness telehealth system bring attention to the unique ergonomic challenges of an elderly population. For example, the difficulty with the mouse during the cognitive assessment exercises suggests that this may not be the appropriate peripheral device for manipulating an object on a computer screen, especially for those who are experiencing arthritis or other musculoskeletal conditions. Older populations may require touch-screens or touch-pads for accurate/comfortable manipulation. Audio perception was also problematic for some users, and emphasizes the need for a comfortable personal hearing device, such as headphones, that can be easily adjusted to the appropriate volume level for people who may have difficulty with hearing. As Alexander and Staggers [24] point out, usefulness of clinical technology is influenced by inflexibility of computer interfaces and poor navigation.

The cognitive assessment exercises, although perceived as useful by the majority of subjects, initiated stress on some users which can actually be counterproductive in achieving wellness. While the software provided reassurance along the way, and the option of exiting and/or restarting the exercises, it did not allow for someone to 'skip' a task, which led to some participants feeling trapped. It is also important for the vendor to consider culture and geographic location when designing cognitive fitness questions that require the user to identify an object that may have several different labels, depending on its geographic/cultural origin. When designed appropriately, the technology can enhance culturally congruent care; for example, in a study about web-enabled touch-screen information kiosks for diabetes care, the kiosks were found to have a function of providing culturally and linguistically appropriate information to a Latino population [25]. Several examples of this challenge arose during focus group discussions, and emphasize the need for these applications to be either geographically neutral or customizable to the user populations. In addition, many users expressed interest in retrieving healthcare information from the internet; thus, a computer with internet capabilities may provide added value to the kiosk for personal research purposes, as opposed to the optional educational videos that were provided for this study.

The optimal location for the kiosk needs to be addressed in the design and implementation phases. A kiosk should be installed in a convenient location where older adults can easily access the kiosk, while it should be in a place where they feel privacy is not violated [26, 27]. When examining the framework by Bellotti and Sellen [20], our findings indicate that capture of personal information in a community setting does not seem to alter privacy considerations. The use of multi-user hardware did not concern participants about an

increased likelihood for security or privacy violations. Privacy was not identified as a concern and the secure set-up of the system appeared to satisfy participants' privacy expectations. The use of a personalized key card for log-in as well as the location of the telehealth kiosk may have contributed to the lack of privacy concerns as stated by all participants. During the sessions, participants discussed the possibility of such kiosks being available in pharmacies or shopping centers, indicating their preference for a community center like the one used in the study. This preference may be driven by privacy perceptions.

In conclusion, there are many values and benefits to implementing telehealth kiosks for promoting wellness in elderly populations, especially when considering the desire for the elderly to remain independent for as long as possible. However, successfully designing and implementing this technology will require careful evaluation of obtrusiveness and human factors and ergonomics principles that are centered on end-user needs. Further research must evaluate the role of human factors and ergonomics in telehealth kiosk design, particularly in the design of this technology for the elderly.

The generalizability of the study is limited by the fact that the work was carried out in a single facility. The demographics of the resident population may not be representative of other retirement communities (for example, the average age for current residents is 88 years, which may be higher than the average resident age in other facilities). We successfully maintained the attrition rate below 5%. Our emphasis on recruitment of older adults informed the study protocol in that the research staff made great effort to first screen residents and to maintain contact, via careful and personalized attention, including bi-weekly in-person contact and as-needed phone calls to subjects to maintain adherence to the research protocol to ensure minimum dropout over the period of follow-up.

The availability of personal data obtained regularly and within community settings also supports the concept of a personal health record (PHR) for older adults that may be accessible via community-based systems such as the one described in this study. A concept emerging from the proliferation of web and other technologies in people's homes and community settings, the PHR is defined as 'an individual's electronic record of health-related information that conforms to nationally recognized interoperability standards and that can be drawn from multiple sources while being managed, shared and controlled by the individual' [28]. Specifically, a PHR is a tool to use in 'sharing health information, increasing health understanding and helping transform patients into better-educated consumers of health care' [29]. A recent initiative for example to implement a PHR system was launched within the Veterans Health Administration system [30]. This PHR system, called MyHealtheVet, currently focuses primarily on appointments, medication requests, protecting the identity of the users and helping veterans obtain a variety of services. The PHR concept is expected to enable a shift from institution-centric to patient-centric models of care as PHRs can be used for sharing health information such as health finances, diagnoses (problem lists), allergies, immunizations, insurance information and medications in an easy way that help people manage their own health [31]. While older adults have the highest utilization rate of healthcare services and are faced with difficult decisions pertaining to care transitions as their healthcare needs change, they have not been identified extensively as potential beneficiaries of PHR applications and included in the design stages.

Technological advances are enabling us to collect and store ever-increasing amounts of multivariable clinical data. As we increase the amount of data we collect, we need to ensure that the plethora of data sets does not become burdensome to consumers and clinicians but instead facilitates decision making. New and efficient methods of visualization are needed to help manage this abundance of information. Capturing overarching concepts such as wellness or quality of life requires the use of visualization tools that will most efficiently capture information both on a macro-level (assessing the overall pattern or status) and on a micro-level (examining trends for individual parameters over time). Curran [32] has argued that one way to reduce the cognitive effort required to understand quantitative information is to present the data in a graphical display, especially when the data are intended to represent change over time. Therefore, for a community telehealth system that presents monitoring data in a meaningful way, it is important to explore the best visualization approach for wellness by assessing older adults', families' and clinicians' information needs and expectations as well as their feedback as to which visual tools can convey appropriate information and enhance health-related decision making.

While the monitoring function of the kiosk may be useful to better understand the dynamic nature of wellness and predict the onset of disease (or deterioration in health) than a series of measurements, it is necessary to consider specific needs of older adults when designing and developing a clinical technology [19]. As our healthcare system struggles to address the complex needs of these populations with limited resources and a well-documented workforce shortage, we are called upon to design innovative approaches that will improve citizens' quality of life and manage increased demand by helping people to live longer and more independently in their own homes. This emphasizes the significance of ongoing monitoring, early detection of adverse events and patterns and early intervention. Ongoing monitoring, however, has been traditionally conducted within the clinical setting and has not been feasible in residential settings (given the prohibitively high cost of healthcare professionals who would have to act as observers in these settings). Reliance on self-reporting of symptoms, well-being and daily activities can be very challenging and often unreliable for healthy adults and impossible for special populations (e.g. adults with cognitive limitations). Engaging older adults as the end users and exploring community settings as potential implementation environments may address some of the challenges of cost-effective solutions for monitoring and managing older adults' wellness. Our study highlighted some of the perceived information needs and attitudes towards community telehealth systems that promote a holistic assessment of wellbeing.

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Table I

Focus group protocol questions.

Key questions	
1.1	Telehealth kiosk
1.1.1	Do you think that this technology may be useful to you or to others?
1.1.2	What, if any, problems do you see with this technology?
1.1.3	Would you be willing to use such a system long term?
1.1.4	How do you feel about being able to see your own personal health information over time?
1.1.4.1	Would you prefer to use the visual display on the kiosk or have printed reports given to you?
1.1.5	How often would you want to receive this information?
1.1.6	Did you find the system easy to use?
1.1.7	Who else would you like to share the information with, that this system provides (for example, a healthcare provider, a family member)? How often?
1.1.8	How often would you like them to receive this information?
1.1.9	Did you access the educational content? If not, why? Would you ever want to?
1.1.10	If yes, then what content and with what frequency?
2.1	Cognitive assessment
2.1.1	Do you think that this technology was useful to you? Do you think that it could benefit others?
2.1.2	What, if any, problems do you see with this technology?
2.1.3	Would you be willing to use such a system long term?
2.1.4	How do you feel about being able to use the program to assess your cognitive function? In general, how do you feel about going through exercises over time to improve cognition?
2.1.5	Did you find the system easy to use?
2.1.6	Would you like to share the cognitive performance information that this system provides (for example, a healthcare provider, a family member)?
2.1.7	Who would you like to share it with and how often would you like them to receive this information?
3.1	Capturing wellness
	We measured aspects of wellness during this study.
3.1.1	What do you think about the things measured in this study (i.e. physiological, cognitive, social and other parameters) to understand one's well-being?
3.1.2	Are there other things we should look at to get a better understanding of older adult's health and well-being?
3.2	Community setting
3.2.1	What do you think about coming to a community room such as this to do these sessions? (cues: did you enjoy it, did you have any privacy concerns?)
3.2.2	Would you have preferred a different setting (e.g. wellness clinic, local pharmacy)?