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Use of mHealth Technologies by People with Vision Impairment

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Abstract

This article presents analysis of qualitative data from two focus groups, one each with individuals with blindness and low vision, respectively, on use of mHealth technologies. The use of mHealth – medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices – has expanded considerably in recent years and is expected to grow further. mHealth offers potential to reduce health disparities between people with disabilities and the general population by facilitating interaction with healthcare professionals and enhancing by supporting personal engagement in health data collection, goal setting and healthy living. People with disabilities – in this case, people with severe visual impairment –may benefit from access to these mHealth technologies and services. This exploratory qualitative research identifies patterns of use, barriers and facilitators, and attitudes to using mHealth. Participants generally did not immediately understand what the term mHealth referred to, but used or had familiarity with mHealth technologies like patient portals, mHealth mobile apps, health monitoring devices (e.g., glucose monitors), and wearable trackers. Participants expressed interest and, in some cases, strong positive affect for using mHealth technologies.

Keywords

Information and communications technology, blind, low vision, mHealth, mobile apps

Introduction

Significant health disparities exist between the general population and people with disabilities, particularly with respect to chronic health conditions (Krahn, Klein Walker & Correa-De-Araujo, 2015). Mobile healthcare (mHealth) – medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants, and other wireless devices (World Health Organization, 2011) – offers considerable potential to help reduce these disparities by facilitating interaction with healthcare professionals and by supporting personal engagement and in health data collection, goal setting and healthy lifestyles.

Worldwide, the number of people with visual impairment is estimated at 223 (Stevens, White, Flaxman, et al., 2013) and 285 million (Pascolini & Mariotti, 2012), including approximately 31 million people with blindness. People with substantial visual impairment often have comorbid health risks and chronic conditions (Court, et al., 2014; CDC, 2018). A review of 2010-2014 data from the National Health Interview Survey (NHIS) by the U.S. Centers for Disease Control and Prevention (CDC) comparing Americans 65 years of age with and without vision impairment, shows the former are more likely to have weak/failing kidney (2.3 times more likely), to have had a stroke (2.0), have arthritis (1.9), diabetes (1.6), heart disease (1.6), chronic obstructive pulmonary disease - COPD (1.6), asthma (1.6), depression (1.5), hypertension (1.4), and high cholesterol (1.3) (CDC, 2018). The combination of visual impairment and other comorbidities has been shown to negatively impact health-related quality of life (HRQOL; Park, Ahn, Woo & Park, 2015) and quality-adjusted life years (QALYs; Park, Ahn, & Park, 2016).

Consumers, healthcare providers and payers have considerable interest and high expectations for mHealth (Zweig, Shen, & Jug, 2018). About half of patients recently surveyed predict that mHealth technologies will improve the convenience, cost and quality of healthcare in

the next three years (Price Waterhouse & Coopers, 2013), and 96% of current mHealth app users believe the apps help improve their quality of life (Research Now, 2015a). Six in 10 doctors and payers believe that its widespread adoption is inevitable, and 7 in 10 believe health apps will encourage patients to take more responsibility for their health (Research Now, 2015b).

Little is known about the mHealth experiences of people with disabilities, including people with blindness and very low vision. Early evidence suggests that people with disabilities are not well represented in the growth of mobile healthcare, and particularly the proliferation of mobile health software applications (mHealth apps) for smartphones and tablets (Jones, et al., 2018; DeRuyter, et al., 2018). This underrepresentation could lead to further health disparities, and perhaps more fundamentally fail to take advantage of new and effective ways of engagement in personal health management. This article presents data analysis from focus group research with individuals with blindness and low vision to map their experiences and needs for mHealth solutions. This is an important initial step for setting the mHealth research and development agenda. Overall, participants reported having numerous chronic conditions and general wellness goals which they manage in part using mHealth tools like patient portals, dedicated personal health devices for monitoring health measurements (heart rate, blood pressure and glucose levels, weight), wearable trackers, mobile apps for health and fitness on their smartphones, the internet for information look-up and reference. Participants also discussed barriers and facilitators for acquiring, using and abandoning mobile health technologies.

Discussion

We conducted an exploratory study on the use of mHealth technologies among individuals with visual impairment (blindness and low vision). Data were collected in 2 focus groups held in March 2018. There were 6 individuals with blindness in one group and 8

individuals with very low vision in the other. Participants were recruited from a local metro-Atlanta organization providing rehabilitation and support for the visually impaired community.

To be eligible for the study, participants had to be 18 years or older, fluent in English, and self-identified as having blindness (little or no usable vision) or very low vision (difficulty accomplishing visual tasks even with prescribed corrective lenses). A recruitment screening questionnaire was used to identify eligible participants and record basic data on demographics (Table 1) and technology profiles (Table 2). Recruitment followed a convenience sampling approach, by which the first individuals who met the inclusion criteria and who could attend the blind or low vision group on the scheduled date were accepted into the study. We did not aim to include participants with specific demographic or other characteristics.

Table 1. Demographic and technology profile (All participants)

Demographic/Characteristics	**Data**
Age range (years)	30-67
Age mean (years)	44
Gender (% Female)	36%
Education (% with bachelor's degree or higher)	50%
Income (% below $15,000 annual income)	50%
Household structure (% living alone)	36%
Assistive technology – use screen reader (%)	86%
Assistive technology – use screen magnifier (%)	57%
Consumer technology – use smartphone	93%
Consumer technology – use tablet	86%

Table 2. Do you own or use any of the following technologies to support your health and wellness? (Percentage of all participants)

Technology Type	**Percentage**
Cellphone	86%
Laptop computer	64%
Tablet	64%
Patient portal	64%
Desktop computer	36%
Dedicated health monitors (glucose, BP)	29%
Wearable device	21%
Automated devices in the home	21%

Data analysis involved a standard approach – philosophically and operationally – to qualitative analysis and grounded theory. The core elements of our approach are well summarized by Hill, Thompson and Williams (1997) in their review of approaches to qualitative analysis: 1) emphasis on description, not explanation; 2) participants define reality, not the researcher; 3) meaning of experience and behavior must be viewed in full complexity; 4) goal of analysis is to generate working hypotheses, not empirical facts; 5) concepts emerge from the data, data are not fitted into existing theory.

Operationally, the research design and procedures utilized were based on the "constant comparative method" (Strauss & Corbin, 1990) which informs most qualitative data analysis. As Hill, et al. (1997) describe the method: "Researchers continuously cycle through the data, making comparisons between the data and derived categories until the core ideas have been verified" (p. 521). A single, semi-structured moderator script was used to ask participants in both

groups open-ended questions about their use of mHealth technology and their health interests and needs. The moderator script was informed by the researchers' previous work in mHealth, technology use, user needs, usability and disability. Though open-ended, the moderator script provided the following core themes for analyzing the transcript data.

- Health Interests and Needs of People with Visual Impairment
- What is mHealth technology?
- What types of mHealth Technology do you use?
- Benefits to using mHealth technology
- Barriers to using mHealth technology
- Specific assistance needed to use mHealth technology
- Discovering new mHealth technologies and resources

Using the constant comparative method, two members of the research team read the focus group/interview transcripts independently to get an overall sense of the tone and content of the material, and to identify major themes and patterns. The two data analysts met to discuss their interpretations, ensure that there is consistency in identification of themes and patterns, clarify and derive consensus on any discrepancies, and ensure saturation.

Below we summarize the themes and concepts coded for both groups (blind and low vision) taken together. While there were some areas of divergence in the specific experiences of each group, these differences were relatively minor. Instead, there was considerable commonality in the experiences, needs, and desires of both groups with regard to attitudes toward mHealth (generally positive), and usefulness and usability of mHealth solutions (some mixed feelings), and sources of information when seeking new mHealth solutions to try. Some

differences in affect (positive or negative feelings and experiences) were noted between the two groups and will be presented.

mHealth Technology: Top-of-Mind Conceptualizations and Actual Use

When asked what comes to mind when hearing the term mHealth technology, participants gave descriptions and provided examples of the types of mHealth technology they were most familiar with and use. Most examples were coded as: patient portals, mobile applications for health and fitness, and medical/health-related devices (Table 3). Other technologies identified were accessibility supports, mobile health trackers, online resources (e.g., healthcare websites, search engines for medical reference, instructional videos), general platforms like smartphones and tablets, and exercise machines with smart device connectivity – but these were not top-of-mind. A patient portal in this study was defined as a secure online website that may be used to: access patient health information, such as medical records, lab test results, and personal health information; schedule appointments; communicate with clinical staff and view health educational information. Patient portals mentioned included several used by Atlanta area hospitals and other care delivery organizations: MyChart, WellStar network app, Dekalb Medical Center's FollowMyHealth, and Kaiser Permanente's KP app. Mobile applications for health and fitness were identified as computer programs on mobile devices (phone/tablet) used to support personal health and fitness goals. Participants in this study used health applications to track fitness (activity/steps take, distance traveled, calories burned, etc.), monitor medical symptoms (heart rate, blood sugar, blood pressure, etc.), and manage medications (reading labels and to set reminders). Examples of health applications used by participants in this study include the Apple health app, the S health app by Samsung, Couch to 5k, MyFitness Pal, various barcode scanner apps, the Fitbit app, the iFit fitness app, BlindAlive, EyesFreeFitness, CARROT apps, SeeingAI, alarm or reminder apps on the phone. Participants in

this study also mentioned trying out apps geared toward improving sleep and managing stress or promoting meditation/relaxation, however no specific apps were stated. Several participants also used personal medical/health related devices to measure vital signs and other clinical indicators, such as blood pressure, heart rate, temperature, blood glucose (sugar) levels, and weight. Participants noted that their medical/health devices were accessible, via voice/auditory interfaces.

Table 3. mHealth Technology Solutions Mentioned by Participants.

Patient Portals	**Mobile Health Apps**	**Medical & Health Devices**	**Mobile Health Trackers**	**Accessibility Supports**	**Online Resources**
WellStar Health Systems	Apple Health	Blood pressure monitor	Activity and fitness trackers	Screen readers	Medical reference websites
MyChart (Piedmont Hosp)	Samsung S-Health	Glucose monitor	Fitness watches	Magnifiers	Search engines
FollowMyHealth (Dekalb Med)	Couch-to-5k	Thermometer	Wearables	RUBY products	Instructional videos
KP app (Kaiser)	MyFitness Pal	Bluetooth scales		Barcode scanners	AppleVis
	FitBit app	ScriptTalk			VIA
	iFit app				
	BlindAlive				
	EyesFree Fitness				
	CARROT apps				
	SeeingAI				
	Magnifier				
	Alarm				
	Reminder				
	Calendar				
	Barcode scanner				

Although most individuals focused on patient portals, mobile apps for health and fitness, and medical/health devices when thinking about the term “mHealth technology”, some also considered mHealth technology to be: 1) an accessibility support, technology that helps to improve access to information due to the limitations, challenges, or differences they have because of their level of vision; technology that simplifies the task of obtaining health information (i.e., reducing the number of devices used to get the health information) and 2) a mobile health tracker, technology that tracks your health on the go; in some case fitness trackers, fitness watches, or wearables could be considered mobile health trackers. Examples of accessibility supports mentioned by participants were screen readers, magnifiers, barcode readers, etc.). Mobile health tracking was a broad concept that was briefly covered, which may need more exploration for future research as to why the individuals with visual impairment did not engage in further conversation about this topic.

Health Needs and Interests

Two themes related to why individuals with visual impairment used mHealth technology emerged from the data: 1) external pragmatic objectives of maintaining good health and managing chronic conditions and 2) internal personal interest and rewards from living well and engaging with mHealth technologies (Table 4). The former focuses on instrumental goals in maintaining health, while the latter reflects intrinsic values on how ideation or state makes the individual feel psychologically.

Table 4. Why participants use mHealth technology

Pragmatic Health Interests and Needs	**Intrinsic Motivations**
General health maintenance	Healthy living
Specific chronic health conditions/disease management	Communication - with others about personal health
Communication with healthcare providers for both general health and chronic disease management	Accountability – with self and others
	Efficiency – ease of tracking health data
	Satisfaction – affirming to see progress in goals
	Entertainment -fun to view information and compete against others
	Inevitability – use of technology is the way of the world

Regarding instrumental goals, participants reported interest in general health maintenance and need for specific chronic disease management. Individuals in both focus groups were interested in maintaining good health and preventing disease and illness. Participants discussed their successes, challenges, tools and techniques for incorporating healthy diets, physical activity, and psychological wellbeing into their lifestyles. They also talked about managing chronic conditions, including diabetes, cardiovascular health (blood pressure, heart rate, cholesterol), and kidney disease. To varying degrees participants used mHealth technology to manage their chronic health conditions and their medications, as well as to maintain good health. They also used mHealth technology to communicate with healthcare providers involved in their healthcare (general health maintenance and chronic disease management). The intrinsic values and psychological rewards participants expressed were coded into seven categories: 1) healthy

living 2) communication 3) efficiency 4) satisfaction 5) accountability 6) entertainment and 7) inevitability.

Health living is grouped here as an intrinsic value derived from use of mHealth technology and is distinct from the instrumental goal of maintaining one's health. Participants expressed considerable enthusiasm for living well, eating right, and getting exercise, and they identified with efforts made to be healthy. Communication, like the concept of healthy living, has instrumental and intrinsic qualities: the pragmatic need to allow healthcare providers, family, and friends to access your health data and intervene on your behalf with permission, especially for chronic disease management; and the psychological comfort of being able to communicate and share personal health data with others. Efficiency of passively tracking data (steps), inputting/logging data (nutrition/diet details), and easily accessing historical data (medical records, clinical measurements) was a major theme identified throughout both focus group sessions. Using mHealth technology for satisfaction, accountability, and entertainment were closely related themes, but distinct concepts that emerged. For satisfaction, participants with blindness expressed "good" feelings about viewing their data/progress made toward their health goals and enjoyment from using mHealth technology. Accountability, which was also only mentioned among participants with blindness, who were referring to the motivation one gets by having access to their own physical activity and health tracking data, and sharing them with friends and family. Several participants with blindness also commented on using mHealth technology for fun or entertainment, competing with self and others to meet activity goals. Finally, inevitability was a major theme discussed by several participants with low vision who noted that society has already embraced the widespread use of technology and mHealth technology is part of this progress. Therefore, it is better to engage with these new technologies for the purposes of promoting and supporting good health rather than be excluded.

Decision-Making Processes for mHealth Technology Use

The processes of selecting mHealth solutions includes discovery, acquisition, and abandonment (Table 5). Discovery is how individuals learn about new technologies. Participants in this study mentioned using various resources to find out about new mHealth technologies, these included word-of-mouth and personal networks (associates, family, and friends); online media (emails, list serves, podcasts, the internet, the App store, curation sites, and social media); and professionals (healthcare, advocates, assistive technology, and researchers). One participant emphasized the benefit of peer-to-peer sharing as part of the discovery process: "I come here, and I learn from other people that have blindness and the technology that [they] have and what works best for them. So, I listen, and I take notes, and I use it in my life." Acquisition involves considering factors that influence the choice to test and adopt use of a specific mHealth technology; these include accessibility, functionality, design, complexity/ease of use, accuracy of data measurements, financial cost, and perceived value/usefulness, When talking about deciding whether or not to download an a new health app, a participant summarized the acquisition process by saying "When I pick an app out, the app got five minutes to impress me, literally five minutes, because if I'm not impressed with the app and [don't] see the benefits of keeping the app on my phone, I don't keep them on my phone because that's a waste of space on my phone. My phone is my lifeline. This is how I find GPS. This is how I keep up with my doctor's appointments. This is how I keep up with everything." Abandonment is the decision (voluntarily and involuntarily) to cease using a specific mHealth technology to support one's health. Participants identified five main reasons for abandoning specific mHealth solutions: 1) the technology becomes inaccessible (updates to operating systems or apps may break accessibility; 2) the person's level of vision worsens); 3) not enough storage/RAM available on their device; 4) a better technology choice becomes available (improved cost, design, function); or 5) the

technology is no longer convenient to have or use (cumbersome to have multiple devices, cords, chargers). One participant described abandonment due to updates by noting: “Some things that make an app obsolete is either when my phone sends me notification of an update or the app itself goes through an update.”

Table 5. Decision-making processes for mHealth technology use by participants

Discovery	**Acquisition**	**Abandonment**
Personal networks & word-of-mouth	Accessibility	Becomes inaccessible (updates to OS or apps; level of vision worsens)
Online media	Functionality	Not enough storage/RAM available
Professionals (healthcare, advocates, assistive technology, research)	Design	Better choice becomes available (cost, design, or function)
	Complexity/Ease of Use	Not convenient to have multiple devices, cords, chargers, etc.
	Accuracy of data measurements	
	Financial cost	
	Perceived value	
	Perceived usefulness	

Conclusion

This exploratory research study is the first step in identifying the current use of mHealth technology by people with vision impairment. Overall, there were similar conceptualizations between the blind and low vision groups regarding mHealth technology and similar experiences

regarding the technologies used, perceived benefits and barriers, health needs and interests, and the process of choosing to use mHealth technology. Both groups identified a range of health concerns and conditions that require regular attention and an ongoing focus on healthy behaviors. Barriers to use focus mainly on accessibility – enabling the technologies with auditory input and output. For individuals relying on screen readers, this functionality needs to be enabled out of the box. Financial cost also seemed to be a consideration, though this was often expressed indirectly. The overall benefits of mHealth technology for both groups included better management of personal health data through electronic tracking; support of physical activity, nutrition, weight, sleep, and stress management goals; access to global health and medical information; and opportunities for improved communication with clinicians involved in their healthcare.

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