Trinh et al., Gerontechnology (2023) 22:1
https://doi.org/10.4017/gt.2023.22.1.841.10

Understanding older adults' perceptions of mHealth apps

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Abstract

Background: Mobile health (mHealth) apps can serve as a tool to aid older adults with their wellness needs such as medication taking or facilitating telehealth visits. However, older adults do not utilize mHealth apps to their full potential. Barriers to adoption could be due to personal preferences or app design limitations.
Objective: The goal of the study was to learn more about barriers and facilitators for mHealth app adoption by using an adaptation of the Technology Readiness Index 2.0 (TRI 2.0) to focus on health technology apps. Our adapted measure included the survey items plus an interview to obtain insights into why older adults use or do not use mHealth apps.
Method: Seventeen older adults (age M = 65.6, SD = 5.19) participated in the study on Zoom. They completed a set of surveys to assess demographic information, technology experience, and technology readiness. They then engaged in the TRI-Health semi-structured interview. Reflexive thematic analysis was conducted to find patterns and themes related to mHealth use.
Results: Older adults shared many facilitators and barriers to adopting mHealth apps. These themes were organized into the Unified Theory of Acceptance and Usage of Technology (UTAUT) model. Overall, they had positive perceptions about the potential for mHealth apps. Nevertheless, they reported barriers, mostly related to use challenges and lack of technical support.
Conclusion: mHealth apps have many uses that older adults can benefit from. However, older adults may need additional facilitators, such as social support and instructional guidance to adopt them. Other factors, such as lack of prior technology experience and their perceived irrelevance to their current health condition, may be barriers to adoption.

Keywords: mHealth, older adults, technology acceptance, health technology, digital health technology

Background

Every year, the older adult population (65 years and older) continues to increase steadily. According to the U.S. Administration of Community Living (ACL, 2022), there were 54.1 million people aged 65 and older in 2019, and the population is estimated to increase to 94.7 million by 2060. To meet their needs, technological assistants can become valuable tools.

The number of older adults using technology has increased in the past years. In 2021, 61% of American older adults owned smartphones, 45% used social media, and 44% owned tablets (Faverio, 2022). We continue to see older adults adopting different technologies, including mobile health (mHealth), which can be defined as "mobile computing, medical sensor, and communications technologies for health care" (Istepanian et al., 2004, p. 405). According to Morey et al. (2019), older adults benefit the most from mHealth applications (hereafter referred to as apps), to aid with general health tasks such as medication taking and managing their health conditions (e.g., hypertension). Apps can aid health needs, such as facilitating communication with healthcare or medication reminders.

There are many mHealth apps available that could be valuable tools for self-monitoring, checking health records, and maintaining wellness for older adults. According to The Global Wellness Institute (n.d.), wellness is "the active pursuit of activities, choices, and lifestyles that lead to a state of holistic health." Wellness could be facilitated through apps that serve as a reminder system to keep up with medication schedules (e.g., taking medication, refilling, and expiring prescriptions), provide a system to facilitate telehealth visits, fitness and wellness lessons and activities, mental health coaching, and more. In a nationally representative household survey on healthy aging conducted in Chicago (U.S.) by Malani et al. (2022), only 28% of the 2,110 polled adults (ages 50-80) reported using at least one mHealth app, while 16% reported using mHealth

Table 1. Participant demographics (N = 17)

Sample characteristics	*n* (%)	*M (SD)*	Range
Sex			
Female	13 (76.5%)		
Male	4 (23.5%)		
Age		68.5 (5.19)	60-78
Education			
High school/GED	1		
Some college	1		
Bachelors	7		
Masters	2		
Doctoral	6		
Household income (US$)			
50,000-74,999k	4		
75,000+	9		
Do not wish to answer	4		

apps in the past but not currently, and 56% had never used one. These data show that many older adults are not currently using mHealth apps, but research is needed to investigate the reasons why they have not adopted them.

Older adults may avoid using mHealth apps due to limitations of the technology itself. Issues such as small screen and font size may affect the quality of usage when viewing items within an app or challenging to navigate if the user has dexterity issues (Gao et al., 2017; Morey et al., 2019). As such, more attention must be devoted to the design, such as content and usability, of apps for older adults to promote initial adoption. Design issues related to visibility, consistency, and within-app navigation may contribute to less adoption (Morey et al., 2019). Additionally, older adults may lack interest, have never thought about it, were unsure about using apps, or be generally uncomfortable with technology use (Malani et al., 2022).

When considering the digital divide, it may seem like older adults are not as savvy with using newer technology like mHealth apps. As health technology evolves, so does the need for understanding its reception and usability. There is much potential to increase older adults' quality of life through mHealth apps. This study aimed to elicit older adults' willingness and proclivity to adopt mHealth apps by exploring barriers and facilitators to adoption through a semi-structured interview. Older adults were asked to recall their positive or negative experiences using mHealth apps. We adapted the Technology Readiness Index 2.0 (TRI 2.0) to have a health focus in relation to the usage of mHealth apps and augmented it with structured interview questions. We explored how mHealth apps are perceived by older adult users. More specific information about the use challenges of mHealth apps will be useful to guide design and instructional support recommendations.

Methods

Participants

The inclusion criteria to participate in this study were being aged 60 or older; having a smartphone; and being willing to use Zoom. We included 17 participants who were recruited through a local university newsletter. Participants were predominantly female, well-educated, and would be classified as middle-income (Bennett, Fry & Kochhar, 2020). Participants had various levels of experience with smartphone technology (i.e., wide-ranging app experience or only necessities such as communication functions). *Table 1* presents demographic details.

Materials

The measures included were as follows:
(1) TechSAge Background Questionnaire (TSBQ; Remillard et al., 2020) assesses demographic information and other participant characteristics.
(2) Smartphone Experience Profile (SEP), was developed to assess familiarity and experience with smartphone apps, modeled after the Technology Experience Profile (Barg-Walkow et al., 2014). For a list of 15 smartphone apps participants were asked to report their frequency of use in the last 12 months (1=not sure what it is to 5=used frequently). The SEP value indicates familiarity with using apps for general categories such as finance or social media. This measure is available from the authors.

Table 2. Technology Readiness Index-Health (TRI-H) interview questions

TRI-H examples	*Interview questions*
Health technology apps contribute to a better quality of life	Can you tell me why you answered that (answer choice)? How do you think health technology apps could affect your quality of life?
Other people come to me for advice on new digital health technology	Can you tell me why you answered that (answer choice)? Is there a person that comes to mind when you need health technology advice? Why does that person come to mind?
Sometimes I think that digital health technology systems are not designed for use by ordinary people	Can you tell me why you answered that (answer choice)? Do you think that health technology systems are overly complicated?
Too much health technology apps distract people to a point that it is harmful	Can you tell me why you answered that (answer choice)? Can you describe an example where health technology apps do more harm than good?

Note: Adapted from the TRI 2.0 (Parasuraman & Colby, 2014)

Table 3. Coding scheme

Category	*Example*
Facilitators	I think the technology apps or the health technology are only trying to make it easier for us to take care of our health and communicate with our doctors or nurses
Barriers	Mentally you check out if you don't want to learn something
Other	If all of a sudden I had a high blood pressure, and I needed to monitor that, then yeah, that would, I would totally do that.

(3) Mobile Device Proficiency Questionnaire-16 (MDPQ-16; Roque & Boot, 2016) evaluates self-reported proficiency with using features on mobile devices such as transferring files from their smartphone to the computer. The MDPQ-16 is scored on a 5-point Likert scale with 1 – Never tried and 5 – Very easily, higher scores indicate more familiarity with mobile device usage.
(4) Technology Readiness Index 2.0 (TRI 2.0; Parasuraman & Colby, 2014) assesses a person's proclivity toward accepting new technologies. The TRI 2.0 contains 16 items scored on a 5-point Likert scale, 1 – strongly disagree to 5 – strongly agree, which are meant to be associated with traits related to technology readiness (optimism, innovativeness, discomfort, and insecurity). The index score is calculated through the formula of (Innovative + Optimism + (6-Insecurity) + (6-Discomfort))/4. The survey items were presented in a fixed order to the participants.
(5) Technology Readiness Index-Health (TRI-H) was a modification of the TRI 2.0 we developed to focus on mHealth apps. For each of the 16 items the word 'technology' was replaced with 'health technology app'. The scoring procedure was the same. To explain the concept of health technology apps, participants were first shown several examples of digital health technology including smartwatches, telehealth, and mHealth apps. They were then asked 16 questions from the TRI-H. After each question, there were two follow-up questions to elicit specific thoughts about why they answered as they did (*Table 2*). The follow-up questions were designed to elicit more thoughts about their experiences and perceptions towards adopting mHealth apps or general digital health technology.

Procedure

Participants who qualified through phone prescreening were scheduled to complete the study on Zoom. After providing consent, participants completed the TSBQ, SEP, MDPQ, TRI 2.0, and TRI-H. Participants were debriefed and compensated with a $25 Amazon eCode. The study session lasted approximately 90 minutes. Responses were recorded in a secure web application focused on surveys and databases (REDCap; Harris et al., 2019). Interviews were recorded through Zoom and stored in a protected health information (PHI) folder and then transcribed for analysis using Otter.ai, an automated transcription service.

Qualitative analysis

The coding team consisted of three individuals with digital health technology, technology adoption, gerontechnology, and aging background. They performed a reflexive thematic analysis (Braun & Clarke, 2019) to find patterns and themes from the collected interview data. We chose this method due to the flexibility of coding participants' experiences with using technology and apps in general. To explore emerging themes, the initial analysis was not conducted with any specific framework in mind but was done using a bottom-up, data-driven approach.

The coders first reviewed three randomly selected transcripts to determine how to distinguish facilitators and barriers (*Table 3*). They individually coded each interview by selecting a full segment and identifying high-level facilitators, barriers, and other codes. The facilitators were defined as variables that would influence older adults to adopt and use mHealth apps long-term or in the future. Barriers were defined as variables that caused older adults to discontinue using or discouraged them from long-term adoption. The code "Other" was used for a few responses that did not fit the main categories. These codes were anecdotes shared about other peoples' experiences, rather than their own.

Each coder extracted subthemes while coding the initial high-level categories. Within facilitators and barriers, subthemes such as convenience or difficulty with instructions were found. Segments could potentially be coded with several subthemes. Once the subthemes were established, the coding team coded eight transcripts to establish inter-rater reliability with a goal of 80%, which is typically the minimum accepted (McHugh, 2012). Once the coders reached 80% inter-rater reliability, the remaining nine transcripts were coded by the first author.

Results

Participant experience and technology readiness

With respect to their general experience with smartphones, participants' scores on the SEP ranged between 2.8 and 4.5, with a mean of 3.62 (SD = .53). The maximum possible score was 5, so this level of experience was above average. For the MDPQ-16 scores ranged between 2.5 and 5.0, with a mean of 4.27 (SD = .66). Participants were proficient in mobile device usage.

The TRI 2.0 and TRI-H indices are presented in *Table 4*. There was not a significant difference between the two. For each measure, we assessed

Table 4. TRI 2.0 and TRI-H

Measure	Mean (*SD*)	Range	Median	Confidence interval	p-value (compared to neutral)
TRI 2.0	3.28 (.48)	2.50 – 4.06	3.31	[3.00, 3.56]	.08
TRI-H	3.31 (.53)	2.25 – 4.00	3.44	[3.13, 3.63]	.01
p-value	.87				

whether the score differed from the mid-point, indicating neutral (i.e., participants are neither low readiness nor high readiness). Neither index was significantly different from neutral.

Thus, in sum, the participants in the study had some experience with smartphone apps generally. Their general proclivity to use technology in general, and mHealth apps specifically, was however neutral. These characteristics of the participants provide the context for the interview data.

Thematic analysis

The reflexive thematic analysis yielded several subthemes related to facilitators, barriers, and other topics. These emergent themes could be categorized by the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Venkatesh et al., 2003, see also Bixter et al., 2019). As such, the initial themes were separated into UTAUT factors: performance expectancy, effort expectancy, social influence, facilitating conditions, experience, and voluntariness. Performance expectancy is "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003, p. 447). Performance expectancy is the strongest predictor of intention as it is the level at which the user believes the system or object will increase their performance. Effort expectancy is defined as "the degree of ease associated with the use of the system" (Venkatesh et al., 2003, p. 450). Effort expectancy can be thought of as how easily the system or object can be used. Social influence is the "degree to which the user thinks that others around them believe they should use the new system" (Venkatesh et al., 2003). Finally, facilitating conditions are factors the user perceives to support using the system or object (Venkatesh et al., 2003). Experience and voluntariness of use are described as moderators of the four main factors.

Facilitators

The older adults expressed positive perceptions toward mHealth apps (*Table 5*). These apps were regarded as a tool to track their vitals (21% of participants) and facilitate communication with health providers (41%). One participant shared, *"I think the health technology are only trying to make it easier for us to take care of our health and communicate with our doctors or nurses."* The older adults found apps to be convenient due to their mobility of usage (41%). This allowed them to access health information and accomplish other tasks, such as ordering their prescriptions. For example, a participant mentioned, *"I can travel and still do all those things I need to do on my phone"*. Convenience and mobility of mHealth apps were noted as factors that help maintain their wellness. These participants mentioned that mHealth apps are convenient because they grant them a sense of control over monitoring their health and meeting their health goals. Goals ranged from weight loss to exercising more through taking additional steps. These goals were further facilitated through reminders provided through various apps. Another participant mentioned, *"It makes me want to exercise more, espe-*

Table 5. Reported facilitators to mHealth adoption

Facilitators	UTAUT theme(s)	Frequency *n* (%)
Convenience	Performance expectancy & Effort expectancy	7 (41%)
Use of new features on a familiar platform	Effort expectancy	7 (41%)
Facilitate communications with health practitioners/telehealth	Performance expectancy & Effort expectancy	7 (41%)
Text or physical manual	Facilitating conditions	6 (35%)
Timesaving	Performance expectancy	6 (35%)
Fill prescriptions	Performance expectancy	6 (35%)
Support from family or friends	Social influence & Facilitating conditions	6 (35%)
Tracking vitals and metrics (i.e., heart rate or steps)	Performance expectancy	5 (29%)
Mobility of use (able to use anywhere)	Performance expectancy	5 (29%)
On the phone rather than a computer	Performance expectancy & Effort expectancy	5 (29%)
Pictures and descriptions (instructional material)	Facilitating conditions	5 (29%)

Table 6. Reported barriers to mHealth adoption

Barriers	UTAUT Theme(s)	Frequency *n* (%)
Technical support speaks with too much jargon	Facilitating conditions	9 (53%)
Not looking for new digital health technology	Voluntariness of use	7 (41%)
Learning curve	Effort expectancy	6 (35%)
It does not apply to them at the moment	Voluntariness of use	6 (35%)
Overly fixated on technology and not listening to the body	Individual differences	5 (29%)
Not wanting to learn new technology	Voluntariness of use	4 (24%)
Lack of technology experience	Individual differences	4 (24%)
It does not help with productivity	Performance expectancy	4 (24%)
Difficult navigation	Effort expectancy	2 (12%)

cially now since my surgery…because before I had surgery, I was hardly able to walk…I've increased my steps up to like, 5 [to] 6000". Another theme was that older adults preferred to test new features within a platform they were already familiar with rather than exploring a new mHealth app. One participant mentioned, *"I like using stuff that I'm familiar within this new feature"*.

Some older adults in this study (35%) shared that providing instructional materials in a physical written (manual) or video tutorial format is most helpful. Participants also reported having social support on mHealth apps and digital health technology usage from family or friends. They stated that their social support consisted of younger family and friends who had more experience with app usage.

Barriers

Although there were many facilitators for adoption, older adults also reported barriers that prevented adoption (*Table 6*). The most frequently mentioned theme was that when needing technical support, they would often not be able to follow the support because too much technical jargon was used (53%). This caused frustration to the participants trying to use unfamiliar apps or features. Another common theme was that the participants were not actively looking for new mHealth apps (41%). Because they lacked experience using apps, the apps are difficult to approach due to the learning curve (35%) or not wanting to learn a new technology (24%). For example, one participant commented, *"if it is complicated, I tend to just stay away from it. If it takes too much effort"*.

Over a third of the older adults reported that they did not currently use mHealth apps because they were irrelevant to them at the moment (35%). They reasoned that they lacked a chronic illness or ailment that required them to routinely monitor. We also found that older adults felt like users of mHealth technology are more fixated on their apps rather than listening to their bodies. This could be why about a quarter of them did not think mHealth apps made them more productive (24%). One participant said, *"I don't think it's right exactly, not more productive, it's just the convenience"*. Older adults may feel more willing to adopt mHealth apps if they were diagnosed with chronic illness, or if they felt that they helped with their productivity.

Other

Codes that did not fit into either facilitators or barriers were placed into the 'other' category. This 11% of the data included anecdotes about family members' or friends' experiences with using mHealth apps rather than their own experiences. For example, *"But I could see how for someone who wants to monitor their blood pressure, or, you know, keep track of their medications or, or some of that I could see how that would be really convenient, or, I mean, really, any of the features, depending on [the] situation."* In general, thoughts were positive about the potential of mHealth apps despite not necessarily having direct experience with mHealth app usage.

Discussion

As the older adult population grows, it is important to investigate why they are not using available technologies to manage their wellness. We learned more about the facilitators that influence long-term adoption and usage, as well as reasons for abandonment or lack of usage, using the TRI-H as an interview tool. We learned more about older adults' perceptions of the usage of mHealth apps, current use patterns, and for some why they had not adopted them but what would be useful about them.

It is important to further our understanding of how health technology is perceived as it continues to be developed with a focus on physical and mental health (Schulz et al., 2014). The TRI-H shaped the conversation for the older adults to share their overall experiences with mHealth apps, whether their thoughts about apps, possibilities of uses, or negative parts of adopting and using them. By using the TRI-H as an interview tool, the data provided a more nuanced and comprehensive view of facilitators and barriers, not captured by using it only as a scaled survey.

Whereas the scale showed a neutral response to mHealth apps, we found several positive factors relating to the features or conveniences of using these apps. Even when they did not use apps, older adults still identified incentives for why these apps would be useful, such as facilitating communication with healthcare providers and convenience. They reported that they would be willing to try mHealth apps if they were to develop a chronic illness. Their current lack of chronic illness may affect how they feel, as they may not want to put effort into learning apps seemingly irrelevant to them. To them, it would be inefficient to learn how to use new systems, especially with no perceived immediate benefits. They also shared their ideas of potential benefits for the general population or their future self. The implication of this finding contrasts approaches of a reactive versus a preventive approach in using mHealth apps. One could argue that by adopting mHealth apps only when a chronic illness is present, older adults might have more barriers compared to learning how to use these apps when healthier. Perhaps guidance from a healthcare provider as a part of healthcare visits, as well as from mHealth developers, would help with providing more incentive and reasoning to use mHealth apps as a preventive tool.

The UTAUT model provided an organizing framework for the themes that emerged from our data. We grouped the identified themes into the concepts of performance expectancy, effort expectancy, social influence, facilitating conditions, and individual differences (voluntariness and experience). When we consider performance expectancy, most participants believed that mHealth apps are convenient, save time on certain tasks (e.g., fill prescriptions), provide mobility of use, and facilitate communication with healthcare providers. The older adults acknowledged that there is some benefit to adopting mHealth apps. However, about a quarter of participants found that mHealth apps would not increase their productivity. For effort expectancy, the older adults seemed to think that mHealth apps were more difficult to learn than traditional apps due to the learning curve and difficulty navigating. This could be due to a lack of mHealth app or general health technology experience. Interestingly, social influence was found in anecdotes about other people's experiences. Older adults shared that because their friends or family had good experiences, mHealth apps are a good tool. The older adults reported that support from family and friends and instructional materials also served as facilitating factors for mHealth adoption. Voluntariness was a decisive factor in deciding to use mHealth apps, along with experience.

In the reflexive thematic analysis, the older adults in this study frequently mentioned how mHealth apps were useful in assisting them with tasks related to their wellness. Our study is limited by including participants over Zoom who had already some level of experience with technology usage and apps, hence it might not reflect the barriers that hinder adoption more broadly. The size and characteristics of our sample also limit the generalizability of our findings. These participants might have differential opportunities to access and test different health technologies. Nevertheless, the insights obtained from these participants were informative for design and further research.

Acknowledgments

This project was supported by the National Institute of Nursing Research of the National Institutes of Health under Award Number R01NR018469. We appreciate Carson Smith's assistance with the data collection and transcriptions.

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