Can Older Adult Emergency Department Patients Successfully Use the Apple Watch to Monitor Health?

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ABSTRACT

OBJECTIVE: To determine usability of the Apple Watch in older adult emergency department (ED) patients after a fall.

METHODS: We recruited older adults who fell and visited two urban EDs. They participated in an Apple Watch orientation and interviews on their experiences using the watch to complete varied tasks for 30 days. Interviews were recorded, transcribed, coded, and analyzed using framework analyses.

RESULTS: Eight participants (mean age 77.6 years) enrolled from November 2019 to March 2020. Participants reported being able to apply and charge the watch but struggled with navigating screens, monitoring charging status, and responding with *de novo* text messages. Many cited difficulties with advanced tasks, such as the study's app-based movement and memory activities. Experience with smartphones and caregiver assistance enhanced users' ability to complete tasks.

CONCLUSIONS: Older adults successfully performed basic Apple Watch functions. Family and community members may be necessary to assist with complex tasks.

KEYWORDS: older adults, wearable technology, Apple Watch, emergency department

BACKGROUND

Each year, one in four older adults fall, leading to nearly 30,000 deaths[1] and costing the United States (US) healthcare system $50 billion.[2] Technological innovations, such as wearables using data collected from sensors such as accelerometers and gyroscopes, could help monitor falls, alert caregivers[3] and medical personnel after a fall occurs, and predict falls. In particular, the Apple Watch, with its sophisticated sensors and fall-detection algorithm, has the potential to benefit individuals, if it is found to be useful in older adults at risk for falls.

Empirical research suggests that simple, wearable activity monitors are easy for many older adults to use, can improve awareness of physical activity levels, and may increase physical activity.[4] However, older adults desire more than usability; they prefer comfortable and aesthetic wearables that are rich in features.[5] The Apple Watch may meet these demands, as it includes fall detection, heart rate monitoring, and electrocardiogram features that could confer health benefits.[6] One major drawback of the Apple devices is cost (prices range from $199 to $1,499), but some Medicare Advantage policies subsidize them.[7]

Existing research on the use of the Apple Watch in older adults has focused on validating the accuracy of its measurements, such as heart rate, energy expenditure,[8] step count,[9] and detection of atrial fibrillation.[10] However, little published work examines the usability of the Apple Watch in older populations. The Unified Theory of Acceptance and Use of Technology (UTAUT) is a framework that has been applied previously to investigate the behavioral intention of older adults using e-Health applications,[11] app-guided fall-risk self-assessments,[12] and telehealth services,[13] but no published studies have explored UTAUT in the context of Apple Watch usage in older adults.

Our objective was to examine the usability of Apple Watch in older adults most likely to benefit from the fall detection features – older ED patients with a recent fall – using the key constructs of UTAUT as our conceptual framework. We sought to explore barriers/facilitators of use, ability of older adult patients who presented to the ED after falling to initiate and continue use after a brief in-ED orientation, and need for assistance with basic and advanced tasks.

METHODS

Summary

We aimed to recruit 30 older adult ED patients who presented following a fall.[14] After 30 days of continuous use – or earlier, if participants were unable to complete the study – we performed semi-structured interviews with participants and/or caregivers to assess the Apple Watch's usability. This qualitative study was designed to understand older adults' lived experience with the Apple Watch, uncover barriers to use, and inform use of the wearable in future studies.

Setting and Population

We recruited at two academic EDs in Providence, Rhode Island: Rhode Island Hospital and The Miriam Hospital. Research assistants screened patients 65 years and older

who had sustained a fall, using the electronic health record. To be eligible, patients needed to meet the following inclusion criteria: English-speaking, community-dwelling, fall not due to syncope or external force or acute serious illness (e.g., acute stroke or myocardial infarction), and likely to be discharged to home/assisted living/rehabilitation at completion of ED visit. Patients with cognitive impairment were required to have a legally authorized representative present to give informed consent. We used the Six-Item Screener to screen for cognitive impairment (scores less than four out of six suggest impairment). We excluded patients with altered mental status, injuries that prevented mobilization, allergies to any device component, and those who were unable to wear the Apple Watch at home or had a diagnosis of advanced cancer or those in hospice care.

Approach, Recruitment, and Training

After written informed consent, participants were trained in device use and study procedures. Once they demonstrated understanding of the basic functionality of the Apple Watch and iPhone, research assistants guided them through movement and memory assessments using the study app: RI FitTest. Participants were instructed to wear the Apple Watch continuously at home except during charging, including in the shower. Participants were asked to complete daily fall surveys and weekly movement and memory tasks using the app. Research assistants called participants on the third day of participation to review study procedures. Research assistants were available to provide technological support by phone or in-person at any time. Staff scheduled an in-person semi-structured interview at 30 days or at the end of study participation, whichever came first.

Theoretical Framework

Our study was grounded in constructs of UTAUT, namely performance expectancy, effort expectancy, self-efficacy, and facilitating conditions. Performance expectancy refers to the degree to which participants believe they will be able to use the technology as it was intended. Effort expectancy refers to participants' perceptions of the ease of use of the watch and RI FitTest app. Self-efficacy refers to participants' beliefs in their ability to perform study tasks. Facilitating conditions refer to available resources participants can access to support their use of the Apple Watch and their participation in the study.

Semi-Structured Interview Procedures

We developed two interview guides – one for participants and another for caregivers of participants with dementia – using questions adapted from prior studies of older adults and further developed by the research team. The interview guides contained open-ended questions with probes specific to the study goals. These questions addressed the four domains of the UTAUT. (**See Appendices**)

A member of the research team conducted interviews with participants and their caregivers (if present) and completed a debrief listing new or emerging themes and observations that may not be obvious on review of the transcripts. All interviews were recorded, transcribed, and de-identified. For accuracy, the research team reviewed and corrected each transcript against the recordings.

Analysis

Data were analyzed using framework analysis, a qualitative analysis method that is systematic and rigorous and involves summarizing findings in charts.[15,16] We (1) read each transcript to familiarize ourselves with the data, (2) developed a preliminary set of codes based on the interview guide and the theoretical framework, (3) coded the first transcript, (4) discussed coding differences to resolve inter-observer differences, (5) reviewed and coded subsequent transcripts, (6) generated additional codes to capture emergent constructs. Both inductive codes, which emerge from the research agenda, and deductive codes, derived from material participants volunteered unprompted, were used. (7) Each transcript was coded by two members of the team using NVivo 12 software. (8) We identified major themes and subthemes across interviews and selected representative quotes, and (9) reduced the content into understandable, brief summaries in charts. The chart headings and subheadings were themes and subthemes; each participant was represented in a row. We created an audit trail of all decisions regarding codes and themes.

Ethics

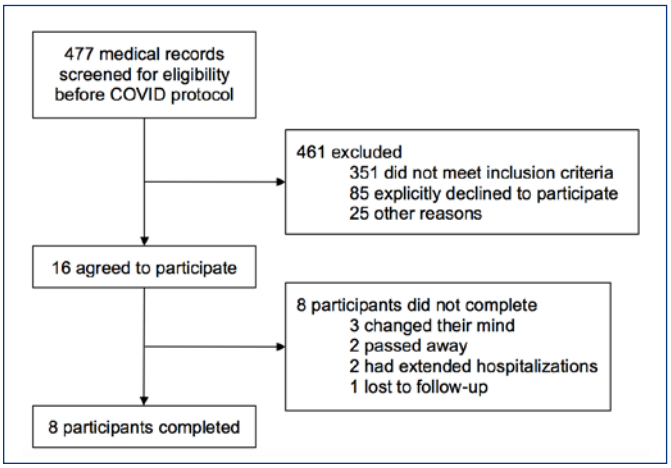
The study was approved by the hospital Institutional Review Board and registered at www.clinicaltrials.gov (NCT04304495).

RESULTS

Participants and Demographics

Due to constraints imposed by COVID-19 starting in March 2020, we stopped in-person recruitment early. As a result, 16 participants were recruited, of whom eight consented to participate in semi-structured interviews (**Figure 1**). The

Figure 1. Flow of participants through the trial



average participant age was 77.6 years (standard deviation 10.0 years), 2/8 were non-white, 7/8 had used a cellphone previously, and 3/8 had used a wearable device (e.g. Fitbit) previously (**Table 1**).

Summaries for each UTAUT construct, along with representative quotes from the participants can be found in **Table 2**. Key existing barriers and potential benefits of Apple Watch use in the older adult population are presented in **Table 3**.

Performance Expectancy

Comfort levels with technology varied; some participants reported owning smartphones and using them daily, whereas others used them "for emergency use only." Most participants had never used the Apple Watch; a few previously used wearable fall detection devices and other fitness trackers, such as the Fitbit. All participants described feeling able to complete the study tasks using the watch and app.

Table 1. Clinical and technology characteristics

Participant #	Age Interval	Sex	Ethnicity	Comfort with technology (out of 100)[a]	Insurance	Living Status[b]	Prior cellphone use	Prior wearable use
1	65–69	F	NHOPI	50	Medicare	Lives with others	Yes	No
2	65–69	F	White	0	Medicare	Lives alone	Yes	No
3	75–79	F	White	80	Commercial insurance provided by employer or spouse's employer	Lives alone	Yes	Yes
4	85–89	F	White	80	Medicare	Lives alone	Yes	No
5	95–99	M	Black	41	Medicare	Lives alone	Yes	No
6	75–79	F	White	30	Medicare	Lives alone	No	No
7	70–74	F	White	40	Medicare & Commercial (bought privately)	Lives with others	Yes	Yes
8	75–79	M	White	93	Medicare	Lives alone	Yes	Yes

[a] The question "How comfortable are you with technology?" was asked during enrollment. Responses were indicated with a 0 to 100 Likert scale.
[b] All our participants lived in the community and none lived in assisted living facilities.

Table 2. UTAUT concepts, data summaries, and representative quotes from interviews

UTAUT Constructs	Summary of Data	Representative Quotes
Performance expectancy	Participants varied in their levels of experience with technology.	Q1: "I play games, I watch news, I catch up on Facebook, Instagram, what my family is doing." (Participant 4) Q2: "I'm not a technical person…I'd rather speak to somebody on the phone. I'd rather visit somebody." (Participant 7)
Effort expectancy	Expectations differed on ease of use of the watch.	Q3: "I avoid technology…I can barely navigate a computer…I'm not skilled enough to…develop a spreadsheet or anything of that nature, I knew…my abilities were limited. I didn't anticipate that it would be a piece of cake." (Participant 2) Q4: "I just figured I'd put [the Apple Watch] on and that would be it." (Participant 6)
Facilitating conditions	Often sought assistance from others, such as family or research staff.	Q5: "I consulted…my granddaughter who's fairly tech savvy…she has an Apple Watch, I bought her one when she turned 13." (Participant 2)
	Mixed opinions about initial orientation/technical support from research staff.	Q6: "You [interviewer] told me more than anyone ever told me…you know I've talked to [RA] and…all she did was call and things. She never explained anything to me." (Participant 5)
	Physical condition while in the ED and/or at home impacted ability to complete study tasks.	Q7: "I thought I would be able to do more…I didn't know what my limitations were going to be after I fell, you know?…I was kind of disappointed that I wasn't able to do more." (Participant 6)
	Participants found the watch to be comfortable.	Q8: "I didn't even know it was on there. It was very comfortable. I forgot it was on." (Participant 3)
Self-efficacy	Participants were divided over their ability to use the watch on their own after the study.	Q9: "I never did figure out…how to navigate the screens. I would answer some text messages on it, if it was one of the options listed as a single word or two." (Participant 2) Q10: "I found this pretty seamless. I didn't have any real difficulty." (Participant 8)
	Participants felt more confident using the watch if others helped them.	Q11: "It was kind of nice having family help." (Participant 4)

Table 3. Barriers to and benefits of Apple Watch use in older adults

Existing Barriers	Potential Benefits
Affordability: The Apple Watch costs $199 or more, and users must own a compatible iPhone (iPhone 6S or later).[17]	Payor support: Some insurance companies subsidize the cost of the Apple Watch to enhance mobility in their enrollees.[7]
Health literacy: Older adults may not understand how to interpret and use the health data collected by the Apple Watch.	Data visualization: Users can access trends over time and graphs of their health measures on the watch.[18]
Digital literacy: Older adults who already struggle with using computers and smartphones may face a potentially steep learning curve to use the Apple Watch. They may perceive that the watch is too complex for them.	Passive tracking: The Apple Watch is able to measure health data, such as heart rate, gait analysis, and oxygen saturation, passively without active involvement by the user,[17] which could enhance ease of use.
Complete integration with healthcare: Although healthcare professionals can be given access to the health data collected by the Apple Watch, most individuals do not give it to their clinicians and Apple Watches are not yet integrated into routine clinical practice.	Data sharing features: The users' Apple Watch data is stored in the Health app on the iPhone and can be shared with healthcare professionals. Some features are programmed to alert designated contacts without involvement by the user after the initial set-up, such as fall occurrences.[18]
Quality-of-life improvement: It is unknown if wearables enhance users' quality of life.	Sleep tracking: Older adults can wear the Apple Watch to sleep and receive basic data on their sleep quality. Step count: Older adults who walk more could benefit from more mobility and a longer lifespan.[19]

Effort Expectancy

Some participants expected the Apple Watch would be difficult for them, while others felt they would "master [the watch] after a few times." One participant expected that using the Apple Watch "would be easy…because the Apple Watch has a good reputation." Participants held similar sentiments regarding the RI FitTest app. One participant expected that the app would be difficult to use, since "I don't like to get into apps and I can't get them off." Another remarked that she did not expect any challenges "as long as it was downloaded" for her.

Facilitating Conditions

Most participants thought the initial orientation was adequate and prepared them for the study tasks. However, one participant expressed frustration with the protocol, "Actually, no one explained to me how it's supposed to work…" (of note: multiple in-person and over the phone attempts by research staff were attempted to explain the study steps, but the participant was noted by the research team to have memory problems).

Many participants noted that their acute condition in the ED, or their health impaired their ability to understand instructions or perform study tasks (**Table 2**, Q7). One participant explained, "Well, I thought that it would be very helpful, [but] I didn't realize that when I got home, my recovery period would take as long as it has."

All participants found the Apple Watch comfortable (**Table 2**, Q8). One participant compared the Apple Watch to another wearable device she wore routinely, "I wear a Fitbit and it's basically the same type of a bracelet, so it's something that I'm accustomed to."

Self-Efficacy

Several participants felt confident in their ability to use the Apple Watch and noted improvements in their ability as the study progressed. Others felt their ability was unchanged. One participant noted that she struggled with navigating various screens, while another expressed frustration at identifying whether the watch was fully charged. Many participants described assistance from family members as essential, and said written and verbal instructions were necessary to use the watch. One participant noted that she was open to try new technology, adding, "As long as I have the correct instructions, I think I'll do fine with it."

DISCUSSION

In this qualitative study of eight older ED patients, participants were successful with performing basic device functions, but experienced varying degrees of success with advanced device features. Those who already used smartphones had more positive experiences and were more able to explore its features, including using the watch to respond to messages and answer phone calls. Those who lacked prior smartphone experiences had more difficulty completing the study tasks on their own. Support from caregivers and/or research staff facilitated positive user experiences and use of advanced features. For the Apple Watch to be feasible for daily use in the older adult population, a high level of sustained and continued guidance and training is likely necessary, whether from technologically-adept family members, friends, or other caregivers, and/or from user-centered instructional tools offered by the device developers.

Future studies could circumvent the challenges we experienced by offering more hands-on training, pairing older adults with younger tech-savvy community members, or

encouraging caregiver participation. Alternative recruitment settings, such as primary care offices, adult day care centers, and assisted living facilities, can be explored to improve outreach to the general older adult population. Additionally, studies of more diverse participants, across ethno-racial groups, socioeconomic status, educational level, etc., are encouraged. We learned that varied training modalities and technological support should be offered, including in-person demonstrations, on-demand video tutorials, and pamphlets with written and pictorial step-by-step instructions. Apple's official "Apple Watch Support" landing page (https://support.apple.com/en-euro/watch) and the Apple Support YouTube channel (https://www.youtube.com/c/AppleSupport) provide guidance in written and visual formats, respectively.

Although we initially aimed to recruit 30 participants, recruitment ended early because the study's Data Safety Monitoring Board ruled that in-ED recruitment was unsafe during COVID-19. Additionally, remote recruitment, consent, and orientation was not successful. Other challenges encountered included eligible patients being unwilling to add another device to the myriad of health devices they were already using, not feeling comfortable with technology, not thinking their fall was a problem, or simply not being interested in participating in our research study. These recruitment challenges were anticipated, given that older adults often refuse participation due to health issues, mistrust, family members' objections, etc.[20] Yet, it is essential to continue to include older adults in research involving technology to address older adult underrepresentation in clinical research and to close the digital divide. Recent research indicates that some older adults are willing to use wearable technologies such as the Apple Watch as part of clinical research participation.[21]

Researchers and clinicians should be aware that many participants relied on the support of the research team to successfully engage with the Apple Watch, and more support is necessary when caregivers are not available to provide assistance. Older adults in the community setting would likely need additional support to use and especially troubleshoot the watch. Additionally, our participants were provided with the Apple Watch and an accompanying iPhone (if they did not own one already) for free, which is not representative of real-world circumstances. The iPhone and an Apple Watch may be too cost-prohibitive for older adults. As wearable technology becomes more prevalent, physicians may integrate more remote health monitoring into their practice, and insurers may expand their coverage of these devices which could facilitate uptake.

We believe these data provide valuable insights into how older adults can be supported to use novel wearable technology. Even if older adults are unable to engage with the advanced feature set of the Apple Watch, its remote monitoring capabilities, including heart rate monitoring, gait analysis, and fall detection – all of which are recorded passively without active engagement with the device – may still prove to be useful. For reluctant older adults, messaging regarding the Apple Watch can focus on the benefits of passive use, rather than its advanced features that require active participation.

CONCLUSIONS

Our results suggest that older adults who presented to the ED after falling are able to wear and charge the Apple Watch after a brief ED training. Their ability to engage with advanced features of the watch is dependent on various factors, including previous experience and comfort with technology and adequate support and instruction from others, such as family and community members. However, some older adults may be poor candidates for this technology. More widespread uptake of wearable technology such as the Apple Watch among older Americans can be expected if device manufacturers make them easier to navigate and if payors subsidize the cost.

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