Exploring Older Adults' Experiences of a Home-Based, Technology-Driven Balance Training Exercise Program Designed to Reduce Fall Risk: A Qualitative Research Study Within a Randomized Controlled Trial

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ABSTRACT

Background and Purpose: With an aging population, falls have become an increasing public health concern. While face-to-face exercise programs have demonstrated efficacy in reducing falls, their effectiveness is hampered by low participation and adherence. Digital technologies are a novel and potentially effective method for delivering tailored fall prevention exercise programs to older adults. In addition, they may increase the reach, uptake, and sustainability of fall prevention programs. Therefore, understanding older adults' experiences of using technology-driven methods is essential. This study explored the user experience of *StandingTall*, a home-based fall prevention program delivered through a tablet computer.

Methods: Fifty participants were recruited using purposive sampling, from a larger randomized controlled trial. Participants were selected to ensure maximum variability with respect to age, gender, experience with technology, and adherence to the program. Participants undertook a one-on-one structured interview. We followed an iterative approach to develop themes.

Results and Discussion: Eight themes were identified. These fall under 2 categories: user experience and program design.

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This study was funded by an Australian National Health and Medical Research Council Health Services Research grant (reference number NHMRC 402791).

The authors declare no conflicts of interest.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.jgptonline.com).

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DOI: 10.1519/JPT.0000000000000321

Participants found *StandingTall* enjoyable, and while its flexible delivery facilitated exercise, some participants found the technology challenging. Some participants expressed frustration with technological literacy, but most demonstrated an ability to overcome these challenges, and learn a new skill. Older adults who engaged in a technology-driven fall prevention program found it enjoyable, with the flexibility provided by the online delivery central to this experience. While the overall experience was positive, participants expressed mixed feelings about key design features. The embedded behavior change strategies were not considered motivating by most participants. Furthermore, some older adults associated the program characters with gender-based stereotypes and negative views of aging, which can impact on motivation and preventive behavior.

Conclusion: This study found digital technologies are an effective and enjoyable method for delivering a fall prevention program. This study highlights that older adults are interested in learning how to engage successfully with novel technologies.

Key Words: accidental falls, e-Health, exercise therapy, health behavior, intervention

(J Geriatr Phys Ther 2021;000:1-10.)

INTRODUCTION

As people age, they are more likely to experience a fall.[1,2] Falls in older age are a major contributor to the burden of disease, with approximately one-third of community-dwelling people 65 years and older experiencing a fall each year.[1,2] Given the aging population, falls have become an increasing public health concern. Falls and fall-related injuries are associated with significant health care costs, and considerable personal and community burden.[3,4] Falls can result in a loss of independence, depression, social isolation, and admission to a care facility.[5]

Systematic review and meta-regression evidence has shown that moderate-to-high challenging balance exercises are the single most effective strategy to prevent falls in community-dwelling older adults.[6] Traditionally, fall prevention exercise programs have been delivered as face-to-face classes or home-based programs. While both modes of delivery have demonstrated efficacy in reducing falls, their effectiveness is hampered by low participation and adherence.[6,7] A systematic review found that adherence to class-based and home-based fall prevention programs was 83% and 82%. respectively, over the first 10 weeks, but dropped to 76% for class-based programs, and 52% for home-based programs after 12 months.[8] Similarly, attrition rates for fall prevention programs indicate almost 34% of participants cease to participate within 12 months.[8] Given many falls are preventable,[9] it is critical to understand why older adults are reluctant to participate in, and adhere to, a long-term fall prevention program. Previous research has identified many barriers to adherence to exercise programs, including the cost of classes, personal factors (ie, attitudes to aging and loss of interest), functional limitations and injury, physical inactivity, limited mobility (ie, access to personal and public transport), and limited access to health and social services.[8,10] Research has found that incorporating behavior change strategies is effective at improving physical activity, especially over the short-term.[11] In addition, tailored exercise programs promote participant autonomy and are therefore seen as superior to generic fall prevention programs,[12] suggesting that they may lead to higher long-term adherence.

Novel solutions for overcoming barriers to participation and adherence may be found through the use of technology. Technology-driven exercise programs using the Internet, Web sites, and mobile applications have successfully improved health and physical activity levels in older adults.[13-18] Technology-driven programs are convenient, provide the user with the flexibility to exercise anywhere at any time, allow for tailoring of exercise progressions and regressions, and can provide individual participant feedback. A systematic review examining community-dwelling older adult's adherence to technology-driven exercise programs provides preliminary evidence to suggest that short-to-medium term adherence may be higher for technology-driven programs.[19]

Recent advances in electronic technologies (e-Health) show their potential to improve health outcomes and health care services. e-Health is broadly defined as the "the use of information and communications technology, especially the Internet, to improve or enable health and health care."[20] Not only do e-Health programs provide an alternative way for people to access health care promotion,[21] overcome barriers to uptake and regular participation in a fall prevention program, they also offer health professionals the means to facilitate strength and balance exercises in the home.[22] Furthermore, COVID-19 has highlighted the importance of telehealth and other technologies in the continued delivery of health care to the population.[23]

Given e-Health technologies may offer a favorable mode of delivering fall prevention programs, it is imperative to gain further insight into factors that influence community-dwelling older adults to undertake an e-Health fall prevention program. This study was nested within a randomized controlled trial (RCT), which aimed to test whether an e-Health balance and exercise program, *StandingTall*, could prevent falls in community-dwelling older people.[24] This study used qualitative methods to explore the experiences of participants using *StandingTall*, a home-based balance exercise program delivered through a tablet-based technology [iPad]. The aims of this study were to: (i) explore people's experiences using *StandingTall*, and (ii) identify the challenges people faced using *StandingTall*.

METHODS

This study was nested within an RCT evaluating the use and effectiveness of the *StandingTall* home-based balance exercise program for preventing falls delivered using a tablet computer. The RCT recruited 510 participants 70 years or older. Participants were randomized to either

a control or exercise group for 2 years. The intervention consisted of the *StandingTall* balance exercise program, which included exercise equipment (a foam cushion, stepping box, and exercise mat) (Figure); exercise videos that featured foot-placement prompts; a tempo clock and timer to facilitate the exercises; self-report rating scales for each exercise; and monthly balance assessments. *StandingTall* was designed using consumer design principles to ensure acceptability by older adults, through interviews and focus groups to exchange and discuss ideas concerning the application.

The exercise group received at least 2 hours per week of individually tailored balance training, via a provided computer tablet, which increased in difficulty over time. The initial starting point was tailored based on the initial built-in balance assessment, which was conducted under supervision by an exercise physiologist. Ongoing intensity of the balance exercises was monitored using a self-report modified rate of perceived exertion scale, and was adjusted as performance changed throughout the trial without the need of supervision. To promote adherence participants who were not achieving the prescribed exercise dose were followed up via phone call for the first 6 months. The balance exercises included static (semi-tandem, tandem, single-leg standing) and dynamic (leaning, walking) balance, training on unstable surfaces (eg, foam cushion), stepping in different directions on an exercise mat, and stepping on a box. Both groups received health promotion education delivered as fact sheets via the tablet computer. The full description of the design, methods, and effectiveness for the *StandingTall* trial can be found elsewhere.[24]

Study Design

This study used a qualitative descriptive design based on the theoretical framework of naturalistic inquiry.[25,26] The consolidated criteria for reporting qualitative studies (COREQ 32) (see Supplementary Table 1, available at: http://links.lww.com/JGPT/A73) was followed. This study was approved by the Human Research Ethics Committee of the University of New South Wales (HC14266).

Sample

Fifty participants from the *StandingTall* trial exercise group were invited to participate. A purposive sampling technique was used to ensure that a range of viewpoints were captured, as well as maximum variability within the sample with respect to age, gender, experience with technology, and adherence to the exercise program.[27] All 50 participants consented to participate. Table 1 provides characteristics of the sample.

Data Collection

Data were collected through semistructured one-on-one interviews by researchers (T.V., J.C.) trained in qualitative interviewing by H.R. Prior to the interview each participant received an information sheet explaining the purpose of the interview. Following informed consent, interviews were audio-recorded to allow for verbatim transcription of the data. Interviews ranged in duration from 45 to 60 minutes and consisted of open-ended questions (Table 2). Interviews were designed by T.V. and H.R. based on Pender's health promotion model (HPM).[28] This model was chosen as it seeks to describe the multidimensional nature of individuals, as they interact within their environment to pursue health,[28] including individual characteristics and experiences, behavior-specific cognitions, and behavioral outcomes.[28] Thus, providing a suitable guide to explore the complex biopsychological processes that motivate older people to engage in health behaviors directed toward the enhancement of health, such as exercise.[28,29] "The interviews focused on: (i) understanding older adult's motivations to use StandingTall, perceived benefits of

Figure. *StandingTall* characters and equipment.

Table 1. Demographic Characteristics

Characteristics	Sample (N = 50) N (%)
Age, median (IQR), y	76.5 (70-90)
Gender	
Female	27 (54)
Male	23 (46)
Education, y	
<12	12 (24)
12	4 (8)
13-15	9 (18)
>15	25 (50)
Health status (BMI)	
Underweight (<22.9)	9 (18)
Healthy (23-30.9)	36 (72)
Overweight (>31)	5 (1)
Residence	
Retirement village	9 (18)
Lives alone	20 (40)
Lives with spouse	23 (46)
Other[a]	6 (12)
Falls	
Experienced ≥1 in the last 12 mo	16 (32)
Concern about falling[b] (≥53)	19 (38)
Experience with technology[c]	
Using a computer	39 (78)
Using a tablet computer	26 (52)
Adherence (median over 12 mo)	
0 min/wk	4 (8)
1-99 min/wk	13 (26)
100-119 min/wk	6 (12)
120-163 min/wk	27 (54)

Abbreviations: BMI, body mass index; IQR, interquartile range; y, years.
[a]Lives with children, spouse and children, relative/friend, or undisclosed living arrangement.
[b]Concern about falling was measured using Iconographical Falls Efficacy Scale (iconFES);
[c]Experience with technology was self-reported.

Table 2. Interview Questions

Part 1	
1.	Tell me about your experience using the *StandingTall* program.
2.	What enabled you to continue using the *StandingTall* program?
3.	What made it difficult for you to use the program?
4.	These cards represent some of the features of the *StandingTall* program: • Which of these features were appealing for you? • What features were not appealing for you? • Is there anything else you would like to say about any of these features?
5.	What would you think of having this program available outside of the research setting?
6.	Is there anything else about your experience using the program, or the program itself that you feel is important and we have not yet discussed?
7.	Finally, I would like to summarize what I have gathered from this interview, and I would like you to tell me if this represents what you have told me and to please clarify anything I may have misunderstood.
Part 2	
8.	Are there any other things you would like to see incorporated to this program?
9.	What are your thoughts regarding adding a strength training component to the program?
10.	And a cognitive training component?
11.	Tell me about your thoughts of doing a home-based exercise program like *StandingTall* versus attending a group-based exercise program.
12.	Do you use the iPad for anything else? If so, for what?

using the program, barriers and enablers to exercise participation and adherence, (ii) which program features were considered facilitators of uptake and adherence, and (iii) identify opportunities to refine the design of the program. Questions were designed to explore 'behavioural specific cognitions and affect' dimension of the HPM: (i) perceived benefits and barriers to action (questions 1, 2, 3, 9, 10); (ii) perceived self-efficacy (questions 1, 2, 5, 9, 10); (iii) activity-related affect (questions 1, 2, 4, 5, 8); and (iv) interpersonal and situational influences (questions 1, 2, 3, 5 and 11)."[28] Each of these variables is strongly associated with an individual's motivation to carry out an action or behavior and is susceptible to modification, making them a suitable target for any health promotion intervention. Probing techniques were used to further explore participants' responses. Interviewers confirmed the accuracy of the data at the conclusion of each interview by summarizing the key points to the participant and confirming that the summary accurately reflected the participant's experience with using *StandingTall*. Participants were then given the opportunity to add additional information they felt was important. Participants each attended 1 interview at 1 of 3 different time points (1, 6, and 12 months) over 12 months. Forty-nine participants were interviewed in their home, and 1 participant elected to be interviewed at the research facility. All interviews were transcribed verbatim and verified for accuracy by a professional transcription service.

Data Analysis

The transcribed interviews were analyzed thematically[27] by M.A. and H.R. Transcripts were read to familiarize researchers with the data, then read a second time to identify text that discussed experiences of using *StandingTall*.

After open-coding 20 transcripts, M.A. developed a list of preliminary codes, including definitions for each code. These transcripts were cross-checked with H.R., where findings were discussed and consensus was reached. All transcripts were then imported into NVivo Version 12[30] to manage and code the data, and maintain an audit trail of the analysis process. Regular meetings with study authors occurred throughout transcript coding. A fourth reviewer (M.S.) reviewed the coding to ensure rigor through a process of investigator triangulation. Throughout data analysis, the codes, categories, and themes were continually refined, with some codes combined, others split into subcategories, and new codes created until the final codes were reached. The final codes were organized into a hierarchical structure (see Supplementary Figure 1, available at: http://links.lww.com/JGPT/A74).

RESULTS

Thematic analysis identified 8 themes, which provide a basis for understanding participants' experience and challenges with using *StandingTall*. These themes fall into 2 main categories: experiences of using *StandingTall* and the design of *StandingTall*.

Category 1: Experiences of Using *StandingTall*

The majority of participants appreciated the flexibility of *StandingTall*'s tablet-based online delivery, and described an improvement in physical awareness and confidence with everyday activities. However, some participants expressed feeling bored while following the exercises, or indicated mixed feelings about the level of challenge the exercises provided. Participants also discussed experiencing various challenges with the technology, and determined that computer literacy is essential for successful engagement.

Theme 1.1: Flexible to access anytime, anywhere

Many participants commented on the flexibility of the program being "the major thing that [they] find really very good" (female, 74, 12 months), which acted as an incentive to participating: "I wanted an exercise program and the thing about the StandingTall one was its flexibility … you could do the exercises at home, in your own time" (female, 74, 12 months). These participants described *StandingTall*'s home-based setting allowing them the flexibility to plan their participation around their weekly schedule:

> I found at home because you haven't got a set time, I've got the freedom of doing it whenever it's convenient. With my situation here at the moment to fix a time every week wouldn't work out too much because I do voluntary work and … looking after the kids (male, 71, 6-months).

One participant observed that this flexibility allowed for couples with different routines to participate: "…I'm a morning person and he's an evening person… we have different patterns…" (female, 80). The flexibility of *StandingTall* allowed one participant to continue exercising when travelling: "When I was travelling overseas … I was able to keep it up" (male, 76, 6 months).

The tablet-based mode of delivery also enabled access to exercise for participants who face barriers to engaging in traditional exercise:

> I suffer from migraines … it takes me out of commission for two to three days. But the other four days of the week are still there for me to do the exercises in. So I've been able to keep up with them. And the same thing goes for any other minor illness … So that's a very great plus as far as I'm concerned (female, 74, 12 months).

Some participants preferred *StandingTall* over exercising in a gym or organized group setting because of the ease of participation: "You don't have to do anything really, you can exercise in your nightie or anything, it doesn't matter … if you're going to the gym you've got to get ready and have a shower and then you might want another shower when you've finished" (female, 80, 6 months); the ability to do the exercises alone: "I quite like it, because I'm not such a groupy person" (male, 70, 1-month); and that it provided similar benefits compared with a structured or supervised group class:

> With a group based you do have to keep [up] and, … you're going from one step to another but with the home one you still have to keep up with the computer. So I think they're very close (female, 70, 1 month).

Theme 1.2: Exercise expectations influenced participants' experiences

Expectations and feelings about exercise influenced people's experience of *StandingTall*. Some participants acknowledged the need to keep moving as you age, even if you are "not a natural lover of exercise" (female, 77, 12 months). Many participants described enjoying participation in the program, although some reported feeling uncertain at first: "… I was so not keen at first, I was surprised at how I quite enjoyed following and I enjoyed thinking, … I'm getting a bit better at this, it's not as exhausting" (female, 77, 6 months). Others described enjoyment of the program as a motivation for continuing:

> I'm quite determined to now, having done a whole year. I can't believe I've done a year, and I enjoy it. And people say they love going to the gym; well I've never been to a gym, and I can't imagine myself going. But I see what they mean by the enjoyment of doing something (female, 79, 12 months).

In contrast, some participants described preferring other forms of exercise such as cardiovascular training where they undertook more strenuous activity, and did not enjoy the gentle approach of *StandingTall*'s balance training: "To be honest, I don't like doing the exercises. And I don't know why, because I've exercised ever since I've been a small boy … Probably because … I've got to push it [the body], strain it [the body]" (male, 85, 12 months).

Theme 1.3: Perception of challenge was mixed

Participant reports about the level of challenge in *StandingTall* were mixed. Some participants described finding some exercises challenging:

> Some things are very hard for me, like where I have to do that rotation around the box, … or keep changing direction; that tends to destabilize … (male, 76, 6 months).

Other participants found the repetition of exercises as "… a little bit monotonous" (male, 70, 1 month) over time, and hoped for new exercises: "… at six months have I reached the top end of all I'm going to do or is there still more brand new things to come …" (male, 76, 6 months). Other participants justified the repetition because of the purpose of the program: "I can understand why that's necessary. But I actually find that it's being helpful" (male, 70, 1 month), and perceived it as worthwhile: "I mean, even though it's easy, it is giving you some good exercise" (male, 80, 6 months). Another participant reflected that they developed discipline through the program: "I think it's good for me to really be able to discipline myself to do it. I like the challenge to do it …" (female, 70, 1 month). Some participants also commented on the difficulty levels within each exercise as motivating improvement:

> Gives you that challenge to progress up for when you're physically not restricted. Same as those that are using a chair to hold on, the challenge there would be, well do this without having to hold on, and you can progress your improvements (male, 71, 6 months).

Theme 1.4: Improved physical awareness, function, and confidence

Some participants described seeing improvements in their performance of the exercises: "You find it's not so hard the second time and you can master it" (female, 84, 1 month), which encouraged some to continue with their weekly exercises: "When I reflect, I didn't like those leaning back things when we first started, and now I can do them easily" (male, 76, 6 months). Other participants described an increase in balance confidence: "Oh just the feeling you're getting a little bit more confident" (female, 88, 6 months); developing their spatial awareness: "that's one thing I've learnt from this whole thing is noticing where your weight is" (male, 75, 12 months); and bringing to their awareness functional issues: "... Well I have discovered that I have a problem. I tend to wobble [while walking]" (female, 88, 6 months). One participant described paying closer attention to their surroundings: "I suppose I'm concentrating more on my walking and stepping for any obstacles while I'm out" (male, 71, 6 months). Another participant described increased self-efficacy:

> I'm not scared now to do anything that would involve my balance because I feel more secure in what I'm doing there and because I know I can do it when I do the toe tapping or the side stepping or on and off the box I'm not scared of falling off there because as I keep saying, I feel more secure now and I know I can do it … I've just developed more self-confidence from it … (male, 79, 12-months).

Theme 1.5: Computer literacy essential for engagement

Participants' experiences with using technology varied. While most participants embraced the opportunity to learn a new technology: "… I'm very interested. I'm very keen ..." (male, 79, 12 months), others described using the iPad as a "…foreign language to me" (female, 77, 1 month), and confessed: "… I had never even seen an iPad; I'd seen a computer but I'd never been able to work it" (female, 79, 12 months). Whereas some participants related their experience with *StandingTall* on the iPad to their previous experiences with similar technology and acknowledged this provided them with the self-efficacy needed to use the iPad without trepidation: "Oh it was fine. But I'm very familiar with computers" (female, 71, 6 months). While others reported feeling frustrated with the technology when things went wrong: "I'd stand there for ages waiting for it to whiz around and download. … I could think of all the other things I could be doing while I was standing there waiting for the exercises" (female, 71, 12 months), and challenged by whether the problem lay with the technology or their own knowledge:

> I was having a lot of trouble with the computer [iPad]. It wasn't doing what it was told, and I didn't know how to control it. So I didn't know if it was me or it (male, 86, 6 months).

Many participants described relying on family members to help them navigate challenges with using the iPad: "Well, I got into a little bit of strife but my son, he probably fixed it up" (female, 88, 6 months).

In addition, many participants discussed how older adults perceive technology in general: "Sometimes it surprises me the lack of knowledge that some people have with the computer" (male, 85, 6 months), recognizing how important it is for older adults to become familiar with using technology: "… they've got to be a little bit computer literate don't they…you've got to get comfortable with using that … apps [applications] and do[ing] Google searches" (male, 76, 6 months). Participants also indicated that despite general perceptions "… a lot of older people enjoy learning about computers" (male, 71, 6 months).

Category 2: Design of *StandingTall*

Despite some technological glitches at the start of the study, participants described the overall design of *StandingTall* as user-friendly, clear, and easy-to-understand. Participants reported mixed perceptions of some of the key design features, including progress assessment and reporting features, instructions, graphics, and value-adding features such as educational fact sheets.

Theme 2.1: Measuring progress, an inconvenience

The monthly balance assessment was included as a tool to provide feedback on progress and was performed

unsupervised by the user. Most participants did not value this feature and assumed the assessment was a data collection tool to aid research: "It's [the assessment] got nothing to do with me. It's to do with you" (male, 79, 6 months). Some participants valued being able to track their monthly progress, considering the assessments "necessary, because you need to keep a tab in your records" (male, 85, 6 months), and reflecting that "It's probably good because it shows you overall … how you've improved for a month" (female, 70, 1 month). However, most people expressed irritation with the monthly assessments: "Yeah, I mean they're annoying" (female, 71, 6 months), with some participants viewing them as "something extra you've got to do" (female, 71, 6 months). Others found the monthly assessments confronting because "it makes you realise … you think you're better than you are…" (female, 71, 6 months).

Many participants expressed disinterest in the progress tracking charts, preferring to get on with completing the exercises: "I just do what I had to and I don't look at the graph" (female, 71, 6 months). One participant observed that it was unclear what it meant to "progress": "…when you say progress, does it mean that you're progressing—there's no sense of what the progress means" (female, 74, 1 month). Some participants described functional self-monitoring as a more important measure of progress: "… I'm not stressed, and I'm not unbalanced, I'm not falling over. I've progressed myself …" (male, 79, 6 months).

At the end of each exercise, participants were asked to rate the perceived difficulty of the exercise, to evaluate their readiness to progress. Participants expressed mixed feelings about this rating scale, with some reporting indifference: "I don't take much notice of that. Some days I'm good and some days I'm bad. So what" (female, 77, 1 month). Others found it ambiguous, misleading, or difficult to use: "I find it difficult to make a judgement" (male, 75, 6 months).

Theme 2.2: Being shown how to do it

Participant perceptions of the video demonstrations of the exercise were consistently positive. Many participants appreciated "The fact that the person … is actually doing the exercises, showing the way to do it" (male, 76, 6 months), and related it to traditional group exercise:

> You feel as if she's in the class with you and, sort of, she's the teacher and I'm one of a lot of pupils I sort of imagine and I'm keeping up with her (female, 74, 6 months).

Many participants valued the demonstration of the foot placement for each exercise: "yeah, positioning your feet on the mat and on the foam, yeah, it's good" (male, 71, 6 months), the timer "…telling you how long you'll be doing it for" (male, 71, 6 months), and the tempo clock for keeping pace: "Especially when I walk away from the area to do the walk" (male, 85, 6 months). However, these features were a point of frustration for some: "I don't know, … it's hard to pick up on the action because like with the feet, you can't tell whether she's tilting back or not" (male, 76, 6 months), and felt limited in how to overcome this: "Some of these things I can't do and yet I can't actually inform the program of the variation I need to do" (male, 76, 6 months).

Theme 2.3: Value-adds not valued by participants

StandingTall incorporated features that were intended to support behavior change strategies and motivate participants to adhere to the program, including a weekly calendar, goal setting, and educational fact sheets.

The majority of participants stated that they did not use the weekly calendar to schedule their exercise sessions, indicating that they "don't really need it" (female, 88, 6 months) or favored freedom over a rigid schedule:

> I don't want to be committed that I have got to do that by a certain time; I'll do it when it suits me so therefore I have not followed through any of that (female, 82, 6 months).

Other participants reported disregarding scheduled exercise times if it became inconvenient: "If something else came up and I said I was going to do this, and I thought, well it doesn't really matter, I'll do it later" (female, 80, 6 months).

Goal setting was integrated into *StandingTall* to encourage engagement and support behavior change. The majority of participants, however, reported "no interest in it at all" (female, 87, 6 months), stating that their only goals were to meet the time requirements: "120 minutes is enough of a goal for me, and I don't need any other goals" (female, 80, 6 months), and avoid leaving it all to the last day: "that's what my goal is, to do it every day, not on the last day" (female, 70, 1 month). Other participants expressed a dislike for goal setting: "… some people like goals, but I'm not one of those" (female, 82, 6 months) or viewed goal setting as a competitive activity: "… for someone who is very competitive, who thinks, you know, going to get 100 more next time, yeah, they might think that's a good idea" (male, 76, 6 months).

The majority of participants perceived the educational fact sheets as unhelpful because "they just tell you what everyone else knows" (female, 87, 6 months), or because "…most people go to the Net about any questions they have, so … I probably wouldn't use it because I'd get it from other sources" (male, 76, 6 months).

Finally, responses to the professionally drawn and age-appropriate *StandingTall* characters (see the Figure), designed to support engagement by accompanying participants as they participated, were mixed. While some participants found the drawings "very clever. Very well done" (male, 85, 6 months), only a few found them relatable: "especially if they're wrinkly like me" (male, 86, 6 months). The majority of participants reported a strong dislike of the characters, describing them as "…a bit of a caricature of old people" (male, 76, 6 months), and critiqued the use of gender stereotypes in the characters' stories. Agism was evident in participants' responses to

the characters, with some objecting to the use of older characters because they "don't want to see an old person" (female, 87, 6 months) and implying that the signs of aging, such as gray hair and wrinkles, were unattractive. Some participants disliked them because they did not identify with their age: "… I don't think of myself as old yet" (male, 71, 6 months), which was reflected in the language used to describe the characters: "No, I'm not a wizened-up grey-haired old lady" (female, 71, 12 months). One participant shrewdly observed that the characters "just remind(s) us of how we're getting older" (male, 71, 6 months).

DISCUSSION

The results of this study provide insight into the experiences of older adults engaged in a technology-driven fall prevention program. Overall, participants found using *StandingTall* enjoyable, describing the flexibility of the tablet-based online delivery as a key feature that contributed to this experience, and aided their ongoing participation in *StandingTall*. This suggests that *StandingTall* may overcome some of the barriers related to traditional fall prevention programs. The nature of the delivery enabled access to a fall prevention program for participants who would have struggled with set class times or functional limitations due to illness. In addition, the delivery mode appealed to participants who dislike group classes or gym settings. Furthermore, participants consistently valued the video demonstrations of the exercises, relating them to traditional instructor-led group classes, suggesting that well-designed programs can simulate the supervision aspect of group-based classes that supports long-term adherence to exercise programs.[31-33] Another factor that contributed positively to participants' experience of *StandingTall* was their self-perceived improvements in balance. Participants described an increased sense of confidence in daily activities, and a greater spatial awareness through continued participation. Personal growth fostered the development of self-efficacy, which is essential for long-term exercise adherence.[34]

While the overall experience of *StandingTall* was positive, participants expressed mixed feelings about some of its key design features. Features designed to measure progress and provide participants with feedback were perceived as inconvenient, irrelevant, and confronting. Participants favored perceived improvements in functional gains as more meaningful measures of progress. Similarly, many participants did not use the weekly calendar to schedule exercise time or the goal setting feature, both of which were intended to support behavior change and motivate participants. Despite the evidence for these features as effective facilitators of behavior change, they did not drive behavior change in this study. This aligns with a systematic review that found that behavioral goal setting, self-monitoring, and performance feedback were associated with low levels of self-efficacy and physical activity,[35] suggesting that commonly used techniques to self-regulate or change behavior may not be effective for older adults.

Poor design is often identified as one of the main barriers older adults have to using technology.[36] *StandingTall* was designed using consumer design principles to equip and support older adults to engage in fall prevention exercises using tablet-based technology. While participants reflected that *StandingTall* itself was easy to use, the technology used for delivering the program presented challenges to many participants, who reported wariness, lack of confidence, and demonstrated low levels of technology-driven self-efficacy. To support participants, a multilayered technological support system was provided for the duration of the program. At installation, each participant was provided with an iPad, a *StandingTall* user manual, a customized iPad user manual, and shown how to use the program. Participants were provided with a telephone helpline and access to an independent information technology support specialist for older adults. However, despite these formal avenues of support, this study found that participants preferred to overcome barriers by seeking help and support from family. Furthermore, while some participants began with a lower level of technological literacy, this study found that participants described an interest in, and capacity for, learning how to engage successfully with technology and acquire and master new skills. Given society's increasing reliance on technology, and the greater access to evidence-based programs that technology offers,[37,38] it is essential that technology-driven platforms are designed to address common barriers and provide support for older adults to successfully use them. In doing so it is imperative we reframe negative beliefs about the capacity of older adults to engage with new technologies. Finally, it is also important to support health professionals to gain skills and confidence in using technology as a treatment platform, which is a key requirement for the successful long-term sustainability of technology-driven platforms.[39]

The World Health Organization encourages the use of positive media images and peer role models to illustrate the benefits and social acceptability of participation in exercise-based fall prevention programs.[40] While studies have found age-appropriate or peer role models more effective at dismantling barriers to participation established by social disapproval,[41-43] the majority of participants expressed a strong dislike for the professionally drawn, age-appropriate characters. While a minority found the characters relatable or inoffensive, the language used by most participants reflected objections to gender-based stereotypes and a negative association with aging. Research has found negative frames of aging create ageist perceptions that impact on motivation and resultant physical outcomes and can affect preventive behavior.[44-46] Therefore, further research into how to best present companion characters to older adults is needed.

Clinical Implications

Technology-driven programs have the potential to reverse the negative spiral falls have on the health of older adults. Falls often result in reduced physical activity, which

increases the risk of adverse health events in an older population.[23] Physical therapists and other health professionals can use technology-driven platforms as an additional mode for successfully delivering treatment and exercise programs to their patient population. Furthermore, as has become more evident with the recent COVID-19 pandemic, the use of digital technologies is becoming an increasingly important tool for delivering health care to the entire population, not just those in remote areas.

Strengths and Limitations

There are several strengths and limitations that should be considered alongside these findings. This is the first study to evaluate the acceptability of an application-based fall prevention program in the home. Furthermore, it includes a large sample size, including people with high and low levels of adherence, and therefore reflects maximum variability within the study population and ensured that data saturation was reached. The outcome measures are client-centered. To minimize the risk of interviewer bias impacting on the data, 2 researchers trained in qualitative interviewing conducted the interviews. Participants' responses may have been influenced by a greater openness to trying new technologies. However, participants recruited to *StandingTall* were aware that they may be required to use tablet-based technology, which may have influenced their overall attitude towards *StandingTall*. Finally, participants included healthy older adults, which may limit the generalization of findings to all patient populations.

CONCLUSION

StandingTall presents a novel and enjoyable solution for older adults to engage in an individually tailored, exercise-based fall prevention program at home. Participants valued the flexibility and convenience of scheduling their own exercise session, but were frustrated by the regular assessments and repetition of the exercises. They also expressed a dislike for the characters and made limited use of features intended to improve adherence. Finally, participants experienced and overcame challenges related to using the technology. This not only highlights the potential acceptability of using an e-Health technology to deliver balance exercises as a fall prevention program to older adults, but reveals an important opportunity to bridge the technology skills gap for older adults. This study highlights the importance of appropriately resourcing any program involving technology, as well as matching the end user to the type of program that fits their comfort level with technology, available resources, health belief system, and level of self-efficacy. Furthermore, COVID-19 has highlighted the importance of telehealth and other technologies in the continued delivery of health care to the population. Future research needs to determine how to best support older adults to successfully engage with technology to ensure they feel confident and build self-efficacy. Future research may also seek to consider how information is delivered to, and acquired by, older adults.

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