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Original Research Article

Using Voice-Activated Technologies to Enhance Well-Being of Older Adults in Long-Term Care Homes

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Abstract

Background and Objectives: Information communication technologies (ICTs) can enhance older adults' health and well-being. Most research on the use of voice-activated ICTs by older adults has focused on the experiences of individuals living in the community, excluding those who live in long-term care homes. Given evidence of the potential benefits of such technologies to mitigate social isolation and loneliness, more research is needed about their impacts in long-term care home settings. With this in mind, we evaluated impacts and engagement of older adults with voice- and touchscreen-activated ICTs in one long-term care home in Canada.

Research Design and Methods: Interviews were conducted with older adults who were provided with a Google Nest Hub Max and with staff as part of a larger implementation study. Participants completed semistructured interviews before the technology was implemented, and again at 6 and 12 months. The interviews were recorded, transcribed, and analyzed using thematic analysis techniques.

Results: We found that residents primarily used the technologies to engage in self-directed digital leisure and to engage with others both in and outside the home, and that this in turn enhanced their comfort, pleasure, and social connectedness. We also identified ongoing barriers to their engagement with the technology, including both personal and structural factors.

Discussion and Implications: Our findings suggest that implementation of voice-activated ICTs can bring added value to broader efforts to improve well-being and quality of life in long-term care by enhancing choice, self-determination, and meaningful relationships.

Keywords: Digital leisure, Information technology, Qualitative research methods, Social isolation, Voice assistant

Translational Significance: The present study found that older adults living in long-term care homes are interested in using voice-activated technologies, and with tailored support, use these to enhance their comfort, pleasure, and social connectedness. These findings underscore the significance of facilitating greater access to these and other types of accessible information communication technologies in long-term care settings to enhance well-being and healthy aging.

Background and Objectives

Approximately 7% of Canadians aged 65 years and older live in long-term care homes (LTCHs; 30% of Canadians aged 85 years and older) and most have complex health needs, including sensory, cognitive, or mobility impairments that can affect social connection and participation (Liu et al., 2016). Given their compromised health and complex disabilities, the limited access to leisure in these settings, and staffing shortages, older adults in LTCHs often have few opportunities to engage in freely chosen and intrinsically motivated activities that are personally meaningful and enjoyable. Loneliness is also a common phenomenon in these settings given the social isolation of residents and their limited opportunities to engage with family, friends, and neighbors; research has found that residents often experience multiple types of loneliness (social, emotional, and existential), with some suggestion that severe loneliness in this setting is at least double that of community-dwelling populations (Jansson et al., 2023).

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Information communication technologies (ICTs) can enhance older adults' health and well-being by facilitating their social participation, engagement in activities, and enabling their access to new kinds of digital experiences that have psychological, physical, creative, and social benefits. For example, older adults' use of the internet (e.g., for entertainment and information), video chat apps, social media, and virtual reality has been shown to be inversely associated with their loneliness and depression and positively associated with increased life satisfaction, social contact, subjective well-being, and good physical health (Beauchet et al., 2022; Fingerman et al., 2020; Gallistl & Nimrod, 2020; Sen et al., 2022). Recent research on voice-activated ICTs suggests that these may be even more beneficial for older adults with disabilities or complex health issues given their accessibility features, relatively simple user interface, and built-in virtual assistant (Nimrod & Ivan, 2022; Pradhan et al., 2019). For example, mainstream and commercially available smart speakers (e.g., Google Home and Amazon Echo) can be used as informal "assistive technologies" to facilitate independent engagement in activities and self-management, accessing information, engaging in leisure, making voice calls, and controlling aspects of the lived environment (e.g., light switches, and thermostat) (Jamwal et al., 2022; Pradhan et al., 2018).

Though there is increasing interest in enhancing access to voice-activated ICTs for older adults in LTCHs, a variety of barriers contribute to the digital exclusion of this population, including lower digital literacy and self-confidence (Czaja et al., 2006; Lafontaine & Sawchuk, 2018; Siren & Knudsen, 2017), higher rates of functional impairment and chronic health conditions (Fields et al., 2021; Matthews et al., 2016), limited access to continuous engagement and support, and outdated technological infrastructure (Fields et al., 2021; Gallistl et al., 2021; Seifert et al., 2020). To date, most research on the use of voice-activated ICTs by older adults has focused on the experiences of individuals living in the community, thus excluding those who live in LTCHs (Arnold et al., 2024; Corbett et al., 2021; Saripalle & Patel, 2024). This is despite the recent "digital push" to increase adoption of ICTs by older adults in LTCHs, primarily to mitigate their social isolation and loneliness (Gallistl et al., 2021; Schuster & Cotten, 2022).

A significant barrier to the use of all types of ICTs in LTCHs is the cultural stigma associated with advanced age and disability, including the common assumption that all older and disabled adults lack openness and interest in learning or using new technologies. Such ageism and ableism are evident in satirical mass media advertisements and popular culture representations of older adults as "technology inept and digitally illiterate" non-users (Schreuers et al., 2017, p. 5). It is also evident in much of the research and public policy on aging and technology that focuses on individual predictors of older adults' lower use of ICTs (as compared to younger populations), which are assumed to be primarily age-related functional limitations (e.g., vision, hearing, and touch) and negative attitudes (Gallistl et al., 2020; Grigorovich et al., 2022; Neven & Peine, 2017). Less research has explored the social and cultural factors that influence older adults' use and attitudes towards ICTs; however, the research that does exist has importantly demonstrated that media representations, access to familial and institutional supports, and to education and training significantly influence both older adults' desire and ability to use new technologies. Specifically, it purports that technology adoption is a complex process of domestication (Gallistl et al., 2020; Nimrod & Edan, 2022; Schreuers et al., 2017), whereby the use of technologies intersects powerfully with other dynamics, including decisional latitude, social supports, and understanding; therefore, there can be considerable leeway for technology to be misinterpreted, resisted, dismissed, or integrated into older adults' everyday practices and routines. This suggests that to encourage adoption of ICTs in LTCHs, implementation efforts must include targeted and tailored education and training efforts that treat older adults as capable of reflecting on their own assumptions and on the relationship between the technology and their own lives (i.e., its added value and fit with their personal goals and interests).

With an interest in understanding engagement and impacts on well-being related to the use of voice-activated ICTs, we evaluated older adults' use and experiences with this type of technology in a LTCH in Nova Scotia, Canada.

Research Design and Methods

Design

The focus of this paper is the primary analysis of interview data collected as part of the larger longitudinal mixed methods LivMore SMARTech evaluation study (https://www.livmoresmartech.com/) that took place at a LTCH that is part of the largest not-for-profit continuing care organization in urban Atlantic Canada. LTCHs in Canada are residential living settings that offer 24-hr nursing and personal care primarily to older adults with complex health needs; types of services available in these settings typically include nursing, rehabilitation, recreation, and personal support with daily living activities. The LTCH in this study is located at one campus of the continuing care organization in a 385-bed building that also includes other types of residential environments and specialized services for older adults (e.g., independent and assisted living retirement, and adult day program). Consistent with broader efforts to decrease ageism in the design, implementation, and evaluation of gerotechnologies (Grigorovich et al., 2022; Lukkien et al., 2021), our study team included a community advisory council composed of older adults living in the community and older adults and support staff from the LTCH, all of whom participated in decision-making throughout the study (e.g., recruitment, data analysis, and knowledge translation). The overall goal of the larger study was to examine the impact of voice-activated technologies on residents' independence, autonomy, and well-being, as well as on care processes. Specifically, the study was conducted to explore the feasibility, usefulness/usability, sustainability, and scale/scalability of implementing this type of technology to enhance the autonomy, independence, and well-being of residents. Our focus here is on the qualitative component of this study, and how the implemented technologies were used for leisure and social connection, which proved to be the main purpose for residents' engagement with these technologies. The two research questions guiding the analysis presented in this paper were:

1. What are the experiences of older adults using the voice-activated technologies?
2. What do they perceive to be the benefits and challenges of using these technologies, including to enhance their autonomy, independence, and well-being?

Participants

Only older adults who were residents of the LTCH were eligible to participate in the study and if they also: (a) had a

mobility and/or dexterity impairment that affected their ability to use an electronic device; (b) had the verbal capacity to use the device (e.g., were able to use their voice to activate the Google Assistant); (c) were capable of providing informed consent to participate in research as determined by them making decisions on their own for other parts of their life and demonstrated understanding of the study objectives and their participation. Eligibility was determined by an occupational therapist employed at the LTCH who identified participants, assessed their capacity, and facilitated their recruitment.

All LTCH staff who provided care to resident participants, including administrators, were eligible to participate and were recruited by the same occupational therapist with support from the nurse managers. Ethical approval for this study was obtained from the Dalhousie University Research Ethics Board and all participants provided verbal informed consent.

Procedures

Residents were provided with a Google Nest Hub Max and with access to Wi-Fi for the duration of the study. This device can be voice controlled using the built-in Google Assistant, and it has a 10" HD touchscreen, 30 W subwoofer speakers, and a 6.5 MP Nest Cam. It also has a number of apps, including Calendar, Photos, Google Duo, and digital games and streaming services such as YouTube and Spotify.

Based on research that has demonstrated the importance of implementing supports for older adults to enhance and increase their digital skills alongside the introduction of a new technology (Gallistl et al., 2020; Mattison et al., 2020), we developed a dedicated Rehab Service at the LTCH. Given the overarching goals of the study, this service included an occupational therapist with experience in assistive technologies and two rehabilitation assistants. The occupational therapist and the assistants were preexisting staff at the home prior to the study. However, with funding from this study, the hours the therapist worked were increased (from 0.6 to 1.0 Full Time-Equivalent or FTE) and one of the assistants was seconded to the study for the duration, with an additional assistant hired in the physiotherapy department.

The occupational therapist conducted assessments to identify residents' specific interests and abilities (e.g., social, emotional, and skills) and developed customized training plans for their use of the voice-activated technology based on their interests and goals (e.g., develop and practice prompts to request a song from a specific artist or play a genre of music based on resident preference, learning how to initiate and end video calls to family member). These training plans were delivered by the rehabilitation assistants. The support provided by this rehabilitation service also further entailed ongoing troubleshooting (e.g., addressing connectivity issues) and supplementing training with using the device as needed (e.g., to achieve new goals).

Data Collection

Data collection began in March 2021 and ended in April 2023, and occurred over three time points for both residents and staff participants: before the technology was installed (T1); 6-month follow-up (T2); and 12-month follow-up (T3). Each participant completed a demographic questionnaire, and semistructured qualitative interviews (30–60 min), all of which were conducted either in-person or over a videocall, as per the coronavirus disease 2019 (COVID-19) pandemic restrictions at the time. The T1 interviews with residents were used to explore their lived experience, needs and desires for independence, autonomy, and well-being, and perceptions about how the implemented technology may support these. The T2 and T3 follow-up interviews (at 6 and 12 months) focused on capturing residents' experiences with the technologies and their impact on their independence, autonomy, and well-being.

Staff were also interviewed (at the same three time points as residents) for the purpose of understanding how the implemented technologies affected their everyday tasks and interactions, as well as their perceptions about the impact of the technologies on residents (see Supplementary Material for the interview guides used at each time point, for all participants).

Data Analysis

Interviews were digitally recorded, professionally transcribed verbatim, and de-identified to ensure anonymity. Our analysis followed the principles of thematic analysis (Braun & Clarke, 2021) and focused on capturing perceptions and uses of the technology for leisure, including whether and how this changed over time as participants became more familiar with the technology. This process began with the first four authors reading all of the transcripts multiple times to obtain an overall understanding of the data and to develop an initial set of descriptive codes based on the main areas of the interview guide (e.g., autonomy, well-being, and experiences with the technology) while also adding inductive codes iteratively based on emergent concepts. These descriptive codes along with text segments were then shared with the rest of the authors, collectively discussed, and further refined; agreement on the coding was reached via consensus. These initial codes were then organized into categories that captured the semantic content of the data, and then were further refined and organized into themes that encapsulated participants' perceptions and experiences of the technology, including its benefits and the challenges experienced with their use. NVivo 12 was used to support data storage, coding, and retrieval.

To ensure methodological rigor and trustworthiness of the analysis (Denzin & Lincoln, 2000), we used the following strategies: multiple authors participated in data analysis; a dependability audit was kept that involved a methodologically self-critical account of research conduct (e.g., reflections on data collection, documenting, and discussing with the team theoretical assumptions, explanations of codes and themes, methodological and analytic procedures); frequent reviews were made of the audit by the research team; and sufficient detail was provided to allow outsider assessment of the "fittingness" of the findings with other contexts).

Results

A total of 57 residents were recruited to participate in the qualitative component of the study and completed the baseline interviews. Of these, 46 also completed interviews at 6 months, and 24 completed interviews at all three time points. In total, 33 residents withdrew from the study primarily due to death or moving to a different LTCH. Twenty-two staff were also recruited and completed the baseline interviews; of these, 11 also completed interviews at 6 months, and 6 completed interviews at all time points.

In total, 10 staff withdrew primarily because they were no longer interested or no longer assigned to residents who participated in the study. The demographic characteristics of the participants are presented in Table 1 below. In brief, resident

Table 1. Participant Demographics

Variable	Mean (*SD*)	*n* (%)
Resident (*n* = 57)		
Age in years	69.18 (13.19)	
Gender		
Woman		39 (68%)
Man		18 (32%)
Current marital status		
Single		56 (98%)
Married/living with a partner		1 (2%)
Highest level of education		
Elementary school (Grade 8 or lower)		15 (26%)
High school diploma		25 (44%)
Postsecondary		17 (30%)
Ethnicity		
White/European		54 (95%)
Black/African/Caribbean		3 (5%)
Time spent living in LTC home (years)	4.73 (4.96)	
Total # of chronic conditions	6.82 (3.41)	
Staff (*n* = 22)		
Age in years	41.30 (13.18)	
Gender		
Woman		15 (68%)
Man		6 (27%)
Other		1 (5%)
Ethnicity		
White		14 (64%)
Black/African/Caribbean		3 (14%)
South Asian		3 (14%)

Note: LTC = long-term care.

participants were on average 69 years of age, women, single, and White. The average age of our resident participants is approximately 10 years younger than the average age of residents in LTCHs in Canada (Canadian Institute for Health Information, 2024). Staff participants were on average 41 years of age, with the majority identifying as women and White.

We have organized our findings into three themes to capture the individual and relational impacts of residents' use of the smart speakers for digital leisure and for social connection, as well as ongoing challenges they experienced with their use. Participants engaged in multiple forms of digital leisure, including playing games, watching videos, information gathering (e.g., news, weather, and community activities), and listening to audiobooks and music. To ensure the anonymity of the participants, interview excerpts below are identified by the type of participant (e.g., LTCH-R for residents and LTCH-S for staff), rather than by their sociodemographic characteristics or professional role, along with their study number and the data collection time point.

Individual Impacts

Residents reported how engaging in digital leisure on the Google Nest Hub Max increased their sense of independence and control over their environment because they could choose what activity they wanted to engage in, and when and how to engage in it based on their own schedule and preferences. This in turn made them feel less of a burden on staff because they were more self-sufficient with these activities. For example, one participant explained this as follows:

> Yeah, I just I feel like I'm not as needy, and like I mean, I don't know, I just feel like I've come to terms with the fact that I can do things on my own, and don't have, I just, I'm self-reliant, more so than what I was probably two years ago. So, I believe even my attitude has changed. I'm just more excited about the fact that I can do things on my own. (LTCH-R 001 T2)

Similarly, another resident explained how engaging in leisure on their own without the help of staff was less frustrating because "it felt like I was a nuisance. Now I can do it on my own … it definitely improved my life a lot" (LTCH-R 010 T2).

Participants further expressed that they primarily used the smart speaker to engage in digital leisure for comfort and relaxation and to self-manage or enhance their emotional and mental well-being. For example, one participant stated that: "I enjoy having it. It's a relaxation thing when I can play games on it, and I really enjoy playing games on it" (LTCH-R 034 T2). Being able to use the device for music to reduce feelings of anxiety as needed in their own room was especially valuable for some participants as captured in the following: "Comfort …when my nerves are bad, I'll turn the soft music on, and I'll listen to that. And I usually feel better" (LTCH-R 049 T2). Finally, participants also stated that the smart speaker was a source of happiness and joy. For example, one stated: "It makes you feel good. Makes me happy" (LTCH-R 010 T2). Not only did residents experience this technology as pleasurable, but participants conveyed tremendous enthusiasm for it, with some even describing it as life-sustaining: "Yes. It keeps me alive … The greatest things … is listening to the music and calling the kids … It boosts my morale" (LTCH-R 026 T3).

Staff's reflections on their own perceptions of the impact of residents' use of the smart speaker echo the benefits that the residents described. For example, staff noted the enjoyment that residents experienced from using this technology to engage in leisure independently in their rooms:

> I just noticed that some of them are … watching videos and they get to choose which ones they watch. A lot of people enjoy the music [the technology] makes it easier for them to access the music … throughout the day. (LTCH-S 004 T2)

Staff further noted that the use of these technologies for leisure enhanced residents' social engagement, and the benefits of this for their emotional and mental well-being:

> [P]eople are more engaged—they're engaged with the technology, and it's causing them to talk about things [to each other and to staff] and look for information … [this] was really beneficial on that small scale … because they have access [to it] 24 hours a day and the freedom to do that, I think, certainly is improving their mental well-being. (LTCH-S 014 T2)

Relational Impacts

Participants also highlighted how the smart speakers facilitated relationships and social connection to others both

within the LTCH and the broader community. For example, residents and staff used it as a tool for learning new information about each other and to engage in digital leisure together, which in turn enhanced their relationships. This is aptly captured by the following staff participant: "I didn't know that [resident name] could really sing. So now we play—we always play music on [their] Google … and [they] sing along, which I think is really, really cool … And it's a lot of fun" (LTCH-S 016 T2).

For other staff, learning how to use the technology was itself a source of engagement as the following illustrates:

> We were trying to get [the Google Assistant to] play a song … I would say something funny or a joke [to activate it] … And then [the Google Assistant] might respond … we were having fun, neither of us really knowing how to do it. You know, so it was a tool for me being able to be one on one with [the resident] … I think that's the best way to put that. It's like we both didn't know what we were doing. So, we were able to be at par. And yeah, [the resident] found humor in that too… it made [them] joyful. (LTCH-S 009 T2)

The smart speaker was also described as facilitating meaningful connections between residents as it provided opportunities for interaction and facilitated communication about the device and shared interests. For example, one resident reported that "at night, [names another resident participant] and I play Yahtzee Solitaire together [on the device] … we're really good friends" (LTCH-R 034 T2). Another shared that "I like to talk about music, but some [other residents] do and some of them don't want to. So, I just go to the ones that want to [and we talk]" (LTCH-R 023 T2).

Many participants also expressed the significant impact of using the technology to independently make video calls to their family and friends, and the ways this enhanced their social connectedness and reduced feelings of isolation. For example, one resident who would call her son and grandchildren explained that it was different than using the phone because she could see their faces and "it just feels like they're more here, closer to you" (LTCH-R 013 T2). Similarly, another resident who called her friends stated: "It's not just a voice on the other end of the line, right? [Y]ou can see their face and … it's just more, um, more fulfilling for me and for [them]" (LTCH-R 059 T2).

The significance of the smart speaker having both a touchscreen and the ability to use their voice to initiate calls independently was also noted by staff as having a significant impact on residents' social engagement:

> I think that they really love being able to see the faces of their family, or their grandkids that may not come in to visit them. Just the ability to have that visual I think they really enjoy, compared to having just a regular phone chat. And not needing to hold the phone or dial the number with their hands, they can just use their voice … it makes it a little easier. (LTCH-S 019 T2)

Relationships between residents and pets were also facilitated by the technology as noted by the following resident:

> [Y]ou feel better when you can look and see the people you want to see, so having like a connection to them, being able to see what's going on rather than just being told about it … I couldn't see their dogs because they weren't allowed to come in [here] for a long time. So, if I call [my children using the technology and] … if the dog's there I can see him too. (LTCH-R 013 T3)

Finally, some residents also shared that they had developed a relationship with the smart speaker itself, and that this in turn made them feel less alone. For example, when asked how she would feel if she didn't have the device anymore, one resident said she "would be lost [because] Google's my—my friend now" (LTCH-R 019 T3). Other participants shared this sentiment in how they would relate to their Google assistant as a real person. As another participant described, "there is sometimes that I feel lonely… and I just like to hear somebody say good night … and … there are times that I do say good night to her [Google Assistant]" (LTCH-R 049 T2).

Challenges

Participants' use of the smart speakers was not without difficulties, and this was despite the ongoing support they received from the rehabilitation service. The most common challenges experienced were personal, in that they were related to participants' own abilities. For example, one resident explained that they forgot the sequence of commands for its use: "sometimes I'll do like the weather, like I'll [ask Google Assistant] questions … [but] stupid memory, and then I forget everything half the time" (LTCH-R 039 T2). Similarly, a staff member described how one resident:

> Has a harder time with getting the Google to answer her, because she forgets that you have to say, "Hey Google," rather than "Google, do this, do that," so sometimes it just kind of gets confusing for her in that way … so she kind of gets messed up with it sometimes. (LTCH-S 004 T2)

Another common challenge was residents' lack of confidence in their skills or knowledge about the technology, including feeling that they were "not tech savvy" (LTCH-R 035 T2) or "not very good at things like that [using technology]" (LTCH-R 052 T2). However, some residents also blamed the technology itself for challenges they experienced with it. For example, as a resident explained:

> I can't get her [Google Assistant] to get Gordon MacRae on … it annoys me that I can't get through to her what it is because it's not that troublesome I don't think. But um sometimes she just doesn't understand. (LTCH-R 049 T2)

Staff similarly reflected on the common frustration that residents experienced when they couldn't get the Google Assistant to do what they asked of it:

> I just keep thinking of one resident … that sometimes has trouble finding what they want, but it's honestly just because they say too many words … like if they asked for a song, the Google may give them something completely different than what they want. Like sometimes they'll ask for a country song and they'll end up with a rap song kind of thing. (LTCH-S 019 T2)

Finally, another challenge that was attributed to the technology itself was the intermittent loss of Wi-Fi connection despite

the LTCH's investment in upgrading its digital infrastructure before and during the study; the home first added new access points and installed Wi-Fi boosters in some rooms to accommodate increased bandwidth and to ensure more reliable and strong signal coverage, and later installed a new generation Wi-Fi network. As one resident explained:

> The internet is touch and go lately … apparently, they're working on it … But yeah, that's about the maddening thing when you get used to something and then it's not with you. (LTCH-R 001 T2)

When staff were asked about the challenges residents experienced with using the technology, many said they wished they had received training to use the technology so that they could engage more with residents using it and help them more when challenges were encountered. As the following participant explained:

> I would like to know everything that the technology is capable of doing for people. So, I know the program exists and I kind of in general know what it does. But is there some sort of an educational component that lets the people who are on the floor supporting people kind of know what the capability of all these things are? Like an education module [for staff]. (LTCH-S 014 T2)

Discussion and Implications

This study demonstrated that voice-activated ICTs offer an accessible and feasible innovation for enhancing the autonomy, independence, and well-being of residents with physical disabilities in LTCHs. Specifically, we found that smart speakers supported residents' engagement in leisure and social activities according to personal interests and preferences. The use of these technologies to freely choose activities to engage in made residents feel more self-confident and less of a burden to staff, and afforded them comfort, relaxation, and pleasure. This is consistent with other research that has shown that the use of ICTs is important for enhancing residents' emotional well-being, self-efficacy, and self-worth (Beauchet et al., 2022; Casanova et al., 2021; Fingerman et al., 2020; Gallistl & Nimrod, 2020; Sen et al., 2022), and that having a sense of control over one's environment and the activities of one's choosing is key to quality of life in LTCHs (Koehn et al., 2016).

Research suggests that older adults in the community typically use ICTs for leisure as well as for instrumental activities of daily living and self-management, including for setting up reminders/appointments/alarms, cognitive training, and self-management of health issues (Nimrod, 2019; O'Brien et al., 2020). However, we found that older adults in LTCHs primarily valued the technologies for facilitating their engagement in freely chosen and preferred forms of digital leisure (e.g., listening to music, watching videos, and playing games). This highlights the capacity of residents to creatively and purposefully engage with the device, including discovering and selecting activities on their own. This importantly contrasts with other smart devices such as those that use bespoke or preloaded content for residents and/or can only be used to engage with content selected by families or staff (Chaze et al., 2022; Kleinberger et al., 2019; Kokorelias et al., 2024). Although such devices have importantly opened up new opportunities for family connection and emotional support for residents, they do not afford the fuller benefits that digital technologies can provide to residents living in LTCHs.

Residents rarely have control over their activities in LTCHs due to the unidirectional provider-as-expert model of care and limited staff resources (Daly & Szebehely, 2012). Yet, enabling such control is critical to culture change efforts to improve the quality of life in LTCHs by supporting choice and inclusion in decision-making (Fortune & Dupuis, 2018). Our findings suggest that ICTs can contribute to these efforts when these technologies are used to support residents' engagement in self-directed leisure rather than as they are more commonly used to only support instrumental activities of daily living/care needs (Gallistl et al., 2020, 2021; Lopez et al., 2021). Moreover, our research supports recent calls to enhance adoption of new technologies by older adults by emphasizing their value to everyday life, including engagement in a particular hobby or leisure interest (Gallistl & Nimrod, 2020; Gallistl et al., 2020; Lopez et al., 2021).

Our findings also demonstrate the potential of ICTs to support relationality in LTCHs. Specifically, we found that residents used the smart speakers to engage in digital leisure with others and to virtually visit with individuals outside the LTCH when they wished, emphasizing the value of being able to initiate social contact with family and friends, as well as with their pets. Given residents' high rates of loneliness and social isolation, this has particular significance. That we found such relational impacts is not surprising given previous research suggests that engaging in digital leisure can increase older adults' number and frequency of social contacts and their feelings of social connection (Beauchet et al., 2022; Freed et al., 2021). Some residents also developed a relationship with the smart speaker itself, or more specifically with its built-in voice assistant, which in turn made them feel less alone. This too is consistent with growing research on the personification of voice assistants, chatbots, and other types of voice-activated ICTs by older adults and their potential for reducing their loneliness by acting as "digital companions (Corbett et al., 2021). Finally, and perhaps our most surprising finding, is that the technology also supported residents' relationships with staff, as they both used it as a means to learn new things about each other and to engage with each other in digital leisure. This was unexpected because increasing older adults' use of voice-activated ICTs is primarily encouraged to increase their independence and to thereby reduce their reliance on formal care services and staff (O'Brien et al., 2020; Schulz et al., 2014); indeed the central goal of our study was to explore the impact of voice-activated technologies on LTCH residents' independence, autonomy, and well-being, as well as on care processes.

The ongoing use of the smart speakers was not without challenges, the most common of which were related to issues with internet connectivity and participants' own abilities (e.g., forgetting the sequence of commands to activate voice assistant). Although the LTCH enhanced its Wi-Fi infrastructure preinstallation of smart speakers, and residents were provided with ongoing support from the rehabilitation service, our findings suggest that additional investment in institutional and support structures is needed to enhance and sustain use. Most LTCHs in Canada have similar types of rehabilitation staff as well as also recreation practitioners (e.g., recreation therapists and activation assistants) who often use technology

to engage residents in group and individual activities; these types of staff can be provided with further training to enable them to support residents with the use of personal voice-activated ICTs as was done in our study. However, diffusing the responsibility for enabling the digital literacy of residents through dedicated training for all staff in LTCHs is a more sustainable and scalable option and would have enhanced the engagement of residents in this study. As but one example, staff participants (who were not part of the rehabilitation service) noted that they wished that they had also received training on how to use the smart speakers so that they could have assisted residents with it. Although some staff were able to learn together with the residents, which was a source of relational engagement, providing dedicated training for all staff in the home could have reduced the number of challenges residents experienced and increased their engagement with the technology.

The importance of developing the digital skills of staff through training and dedicated time, and enhancing Wi-Fi connectivity across LTCH environments, has been identified by others who suggest that mitigating these barriers could further enhance adoption of ICTs (Chu et al., 2021; Davitt & Brown, 2022; Seifert & Cotten, 2023; Wilson et al., 2022). In addition, previous research (Chen et al., 2021; Kim & Choudhury, 2021; Ruggiano et al., 2021; Smith et al., 2021) has similarly identified the challenges we found in relation to individuals' capabilities being barriers to their use of commercially available voice-activated ICTs. As such, important recommendations for industry include the redesign of such technologies to minimize the impact of users' capabilities on performance and to scaffold learning (e.g., prompts and feedback provided to "failures") as well as to improve speech recognition to accommodate for age and disability-related vocal characteristics (e.g., pauses, hesitations, and volume). Such modifications will be important to minimize frustration and prevent abandonment and to expand access to voice-activated ICTs for older adults with speech impairments and/or varying cognitive abilities.

Our findings demonstrate that older adults with disabilities living in LTCHs are capable of, and are interested in, learning how to use new technologies and thus offer a powerful counter-narrative to existing ageist stereotypes of them as technologically incompetent and uninterested (Gallistl et al., 2020; Grigorovich et al., 2022). To this end, our study highlights the potential of voice-activated ICTs to reduce the "digital divide" (Selwyn, 2004) and underscores the imperative of increasing access to these types of ICTs to enhance well-being, healthy aging, and quality of life in LTCHs. It is important to note that our participants were on average 10 years younger than the average age of residents in LTCHs in Canada and were not living with a cognitive impairment; approximately 65% of all LTCH residents in Canada are living with moderate-to-severe cognitive impairment (Canadian Institute for Health Information, 2024). Given that there is some research that demonstrates that older adults living with cognitive impairment can engage with different types of ICTs and perceive these to be beneficial/enjoyable (Astell et al., 2024; Canadian Institute for Health Information, 2024; Du et al., 2024; Hung et al., 2023; Kokorelias et al., 2024), the voice-activated technologies used in the current study may have similar benefits; however, this will be for a future study to explore and in particular to identify what additional supports such individuals may need to fully engage with these technologies. We do agree with Chu and colleagues (2021) that there is an urgent need to address the structural constraints that contribute to the digital divide in the sector, including ensuring that all residents have access to stable and free Wi-Fi and the strategic procurement of accessible software and peripheral accessories that enable residents' independent use of technologies. The latter is particularly important to ensure that efforts to promote residents' well-being through access to social technologies can be balanced with the current time and financial constraints of the long-term care sector.

Finally, although our findings are consistent with previous research on the individual and relational impacts of ICTs (Corbett et al., 2021; Freed et al., 2021; Nimrod, 2019; Schulz et al., 2014), our study contributes to this research by including the perceptions of residents themselves rather than relying only on the perceptions of care providers or other LTCH staff (Davitt & Brown, 2022; Edwards et al., 2021), which is far more common. This is even despite the high attrition rate of our study; the residents who remained in the study provided such richness in terms of their perspectives and experiences. The engagement of older adults in research on the design and implementation of ICTs is key to decreasing digital ageism and more broadly to ensuring that older adults have equal opportunity to convey and delineate what is ethical with regards to the integration of technologies into care settings (Berridge & Grigorovich, 2022; Lukkien et al., 2021).

Limitations

First, although a principal finding of our study was the relational impacts of engaging with voice-activated ICTs, this was not an explicit focus of our data collection and thus there may be other types of relational impacts that were missed. Second, the COVID-19 pandemic and related restrictions on social interactions in LTCHs during the data collection phase of this study may have influenced participants' engagement with the technologies for social connection. Although social isolation was exacerbated by these restrictions, these relational impacts are still significant given that social isolation has long been recognized as a significant quality of life concern within LTCHs (Jansson et al., 2023). Nonetheless, it will be important in future research on ICTs in LTCHs to explicitly explore relational impacts in the context of more typical everyday life. Finally, although digital literacy was not an inclusion criterion for our study, it is possible that our sample included individuals who already have some experience and comfort with engaging with technologies. Given we restricted participation in this study to residents who were capable of providing informed consent, and that the study setting was in Atlantic Canada, it is not surprising that our participants were relatively young and mostly White/European. Our sample also reflects previous research that suggests that technology use in LTCHs is associated with relative youth and identifying as a man (Seifert & Cotten, 2023). Yet given that most residents in LTCHs in Canada are women (~65), with at least a third being over 85 years old (Flanagan et al., 2021), it is thus possible that our findings may not reflect the experiences and impacts of engaging with voice-activated ICTs of more diverse residents in this setting. Given that research shows that digital literacy and attitudes toward technology in later life vary greatly across individual characteristics (Gallistl et al., 2020), in order to further address the digital divide, it will be important to specifically target individuals in LTCHs who lack

experience with ICTs and the opportunity to engage with them, including older women, persons living with cognitive impairment, and those from racialized and/or immigrant communities.

Conclusions

This study contributes to understanding engagement and impacts related to the use of voice-activated smart speakers by older adults living in a LTCH. Findings suggest that older adults experienced both individual and relational benefits to their well-being from using this technology, and that they primarily used it to engage in digital leisure and for social connection. Despite our investment in social and structural supports to enhance digital literacy and facilitate engagement, participants still experienced challenges, which may be mitigated with additional training for LTCH staff. It is our hope that this research provides important direction to ensure that older adults are supported to the fullest extent possible to use new technologies for self-directed leisure.

Supplementary Material

Supplementary data are available at *Innovation in Aging* online.

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Conflicts of Interest

None.

Data Availability

Data from this study cannot be made available to other researchers for reasons of protecting the anonymity of the participants and because they did not provide consent for their raw data to be shared publicly. Susan Kirkland, a co-author of this study, can be contacted at susan.kirkland@dal.ca about any possibilities of seeing aggregated or anonymized parts of the data set.

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Author Contributions

All authors provided intellectual contribution to this manuscript and reviewed and approved the final version. Conception and design: S. Kirkland, M. Szabo, A.-A. Marcotte, A. Grigorovich, and P. Kontos. Data collection: D. Blais and C. MacNeill. Data analysis: A. Grigorovich, P. Kontos, M. Szabo, A.-A. Marcotte, R. Colobong, G. Giffin, K. Clahane, I. P. Goldman, B. Harris, A. C. Caseley, M. Gaunt, J. Vickery, C. Torrealba, and S. Kirkland. Writing of the original manuscript: A. Grigorovich, P. Kontos, and R. Colobong.

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