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Post-pandemic digital realities of older adults

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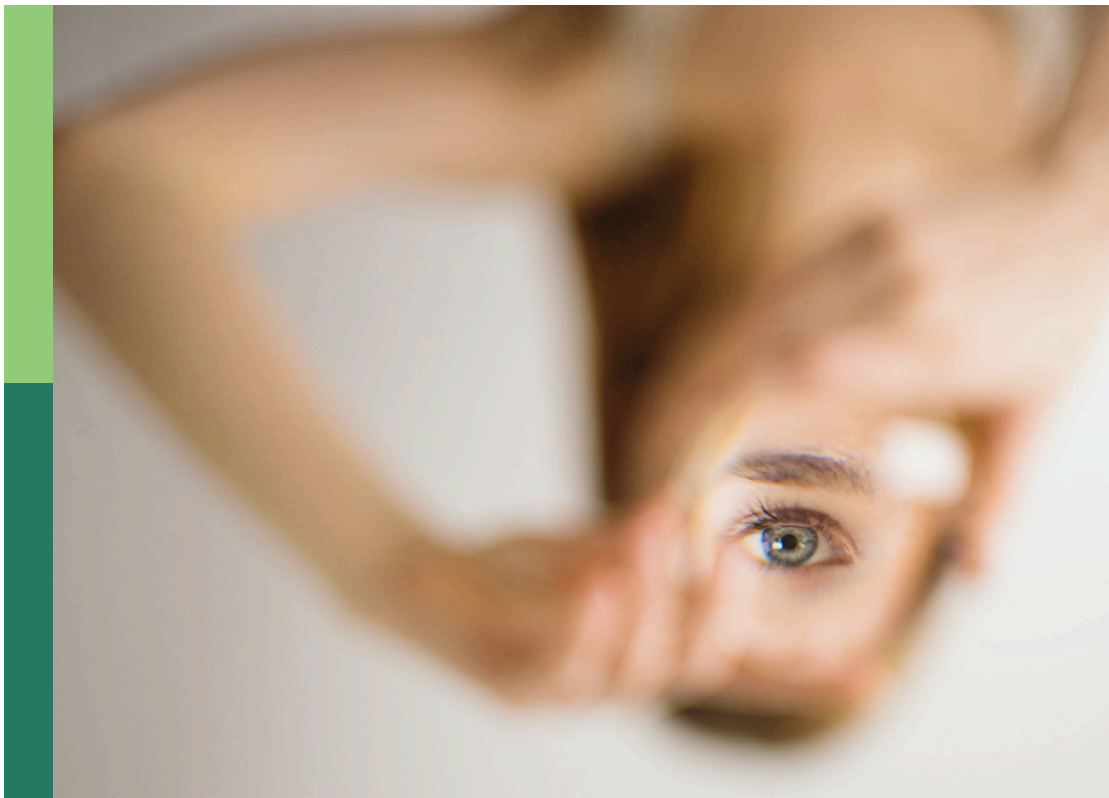

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Post-pandemic digital realities of older adults

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Table of contents

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Editorial: Post-pandemic digital realities of older adults

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Editorial on the Research Topic
Post-pandemic digital realities of older adults

The COVID-19 (SARS-CoV-2) pandemic is to date the phenomenal event of the 21st century and of 2020, leading to global lockdowns and various directives rolled out by governments to protect their citizens (Marston and del Carmen Miranda Duro, 2020; Marston et al., 2023a). A whole new way of life started to unfold for all of us, in which what we had known in the preceding years was no longer the same, and our routines of commuting to work and socializing with friends and family ceased, leisure activities were curtailed, education delivery was transferred onto digital platforms, and many of us were only allowed out of our homes for essential reasons, including shopping (e.g., groceries and collection of medication) or for work purposes (Mandache and Ivan, 2022).

Since the beginning of the 21st century, digital technologies, practices, and transformation have been moving quickly, but the events of 2020 exacerbated this process, leading to services and platforms becoming the primary "go-to" place for everyone who owned a digital device and who had access to the Internet and the digital skills to engage with the platform(s).

This phenomenal event has led scholars from across many disciplines to come together, form new networks, and collaborate on innovative projects (Ivan and Cutler, 2021a; Earle et al., 2022; Ratzenboeck et al., 2022; Marston et al., 2023b; Taipale et al., 2023) in an attempt to capture the lived experiences during 2020 and 2021. The scholarly activity that has been conducted will provide insights for future scholarly historians, social scientists, technologists, and many others who will be curious to understand how digital transformation came into the fore and how people adapted to a new way of living in a post-pandemic society, as well as to learn about the experiences during this time.

The primary focus of this Research Topic is to present and contribute to the discourse of digital technologies and practices during the COVID-19 pandemic.

The articles in this Research Topic are broad, and its topics include (1) robotics (Berridge et al.; Maalouly et al.) from the perspective of the US and Japan; (2) the perceptions of people from the UK on the role of digital companions in reducing loneliness (Martin et al.); (3) Chatbots (Iancu and Iancu); (4) the role of videoconferencing in nursing homes in France (Racin et al.); (5) mobile and wearable technologies (Fowe and Boot); (6) interacting with QR codes and purchasing items using contactless payment options (Morrison et al.); (7) digital exclusion, digital skills (Wilson-Menzfeld et al.) from a UK perspective, digital literacy (Finkelstein et al.) in the context of the US, and digital inclusion (Reuter et al.) observed in Sweden.

These articles add to a growing body of research focusing on this once-in-a-lifetime event of the 21st century (Renu, 2021; Ummer et al., 2021; Vargo et al., 2021; Freeman et al., 2022; Smith et al., 2022), including the wider societal debates of digital technologies and practices by people across the life course and understanding transgenerational perspectives of and interactions with technologies (Marston et al., 2020a, 2022; Ivan and Nimrod, 2021).

Berridge et al. present a study exploring the interest in and use of "companion robots" or "artificial robots" as a way of mitigating loneliness and understanding the ethical issues associated to them. This study recruited 496 people, who ranged in age from 25 to 88 years, and the statistical analysis explored the relationships between age, health, and perceptions toward the impact of loneliness and comfort surrounding deception. The findings showed that 68.7% of participants thought that artificial robots would make them feel less lonely, although nearly 70% reported that the use of artificial robots would make them feel somewhat to very uncomfortable with the idea of making the individual believe that a robot is human. Overall, this study notes how there was no strong belief that artificial robots would alleviate loneliness, and in respect to deception, it is posited that future solutions need to consider design implications to prevent this likelihood.

Maalouly et al. present an experimental study in which older adults tele-operated a robot to get involved in prosocial activities in two experimental situations: engaging in a conversation in which they would give information to visitors about their city and talking with children from a children's center to offer their support. The two situations were used to understand how older adults experienced remote-controlled work, how it was to start a new job in a remote situation, how their social interactions had been affected by the COVID-19 pandemic, and whether they were willing to conduct some of their voluntary activities using a remote-controlled robot. The results of this study show the potential of robots to replace some face-to-face interactions in organizing older adults' meaningful activities in times when their ability to have such face-to-face interactions is limited.

Martin et al. also investigate the role of robots to mitigate loneliness, offering a different perspective: people's views on the role of an artificial companion (AC) regarding deception with dementia and its role in reducing loneliness. The study raises some important concerns regarding the ethical issues of the current design solutions concerning artificial companions. The participants did not think that a companion robot would make them feel less lonely, and they felt that the deception of allowing people to believe that an artificial companion is human would make them feel uncomfortable. The participants challenged the role of a potential artificial companion in mitigating loneliness, the social desirability of such an innovative technology solution, and raised important moral concerns, regardless of their age and gender.

Racin et al. discuss the role of videoconferencing for older adults in nursing homes during the COVID-19 pandemic using the concept of "mediation". Practices of interaction with families and friends using videoconference applications were revealed using interviews and observations undertaken among residents, their relatives, professionals, and the management teams, showing considerable inequalities in terms of skills, subjective feelings, and ownership of the videoconferencing tools. Although designed to increase the positive effect on older adults, social interactions, and wellbeing, the difficulties associated with the use of teleconferencing in nursing homes have emerged and have been deeply analyzed in this study, raising the question on dependency, protection, respect for people's autonomy, and failure to consider residents' feelings and disturbance in the situation.

Iancu and Iancu present insights into the perceptions of chatbots among adults in mid and later life based on a sample of 235 people ranging in age from 40 to 78 years. This study contributes new knowledge to an area that has to date primarily focused on younger people between 18 and 34 years of age because of the common belief of their experienced use of technologies. The findings from this study note the perceived ease of use and behavioral intention were important factors for using chat bots, especially if engagement was useful, in addition to positive feedback or opinions from other people. However, gender and age showed no effect in relation to behavioral intention.

Morrison et al. present a qualitative study and survey and an additional nine interviews to understand the issues and types of engagement experienced by older adults interacting with various digital practices, such as QR codes and paying for items using contactless methods and apps via smartphones. The findings, via a thematic analysis approach, highlighted two factors: (1) Intrinsic—digital literacy and (2) Extrinsic—technology glitch or breaking, which in turn lead to a reduced opportunity for social inclusion and feelings of embarrassment in the physical space. The digital divide continues to grow, and this study contributes knowledge to understanding how during the Fowe and Boot present a study focusing on technology use to facilitate remote monitoring and virtual care of patients and people, respectively, with a view to affording greater efficient and effective methods in our growing aging populations. A quantitative survey was deployed to 92 community-dwelling adults to explore their attitudes toward using wearable and mobile technologies associated to (1) predicting cognitive decline, (2) assisting with adherence to healthy activities, and (3) collecting self-report data to understand current and predict future health states. Overall, the findings ascertained that in theory, and from a hypothetical standpoint, digital solutions would be useful, and there was an interest to learn more and a willingness to adopt digital solutions for these purposes. However, the findings did show a neutral response regarding concerns associated to data privacy generated via the digital solutions. Further, these concerns showed a lesser interest and willingness to adopt digital technologies, while there were greater positive associations to

acceptance and willingness to adopt digital technologies based on positive attitudes and proficiency with mobile devices. Respondents of the survey who self-reported to have poor health showed a negative attitude toward digital technologies, and this too highlights the barrier-targeting interventions to increase the adoption of digital technologies.

Wilson-Menzfeld et al. present findings from a study primarily focusing on the perceived facilitators and barriers toward a remote digital skills programme, and they ascertain whether this method of training could be utilized as an alternative to face-to-face methods. Their findings identified two key themes: (1) creating a unique learning environment and (2) encouraging further learning. While there were barriers to this mode of delivering the programme, they also identified positive factors, including the personalization and individuality of the programme delivery, which in turn empowered the participants within their own learning experiences, and skills were learnt that were relevant to the individual, resulting in the individuals continuing their digital learning.

Finkelstein et al. present findings from a study conducted in New York City and in conjunction with a multi-service organization to explore and understand the patterns and experiences of the adoption and use of digital technologies by older adults who had received devices, unlimited broadband, and technology training via the organization. Qualitative data were collected from 35 older adults who were in receipt of the digital devices, connectivity, and training, ranging between 55 and 90 years of age. Additional characteristics of the older adults highlighted were that they constituted a racially/ethnically diverse group (Black 29%, Latino 19%, White 43%) and all had low incomes. The findings from this study show that training programs designed with a one-size-fits-all approach do not necessarily work, and instead, training should be customized to reflect the skills that are needed instead of primarily basing it on age. The authors posit and recommend that service-led organizations should include and conduct technology assessments relating to access and use in other standard protocols.

Reuter et al. posit in their article the need to look toward the future in a post-pandemic society, and while digital inclusion is important and was highlighted during the pandemic, digital participation is also important to identify and augment opportunities for everyone in our communities and society. Moving forward, Reuter et al. argue the need to implement a macro-, meso-, and micro-level approach to enable and facilitate digital participation in later life, with a view to establishing a multifaceted and a multisectoral approach to partnerships associated to environmental factors. This approach has the potential to appropriately design and implement digital participation programmes, with additional evaluations to be considered concerning the needs and lived experience of older adults.

In this Research Topic, there is strong discourse surrounding digital skills, literacy, inclusion, attitudes toward and perceptions of digital technologies, and practices that are integral to current and future research investigations associated to digital technologies and practices. What is noticeable as we transition into a post-pandemic society, as we reflect upon the pandemic, is that many people in our communities and society in general were excluded from societal activities and access to vital information, as well as being able to access information via QR codes (e.g., restaurant menus) or government websites and other associated services pertinent to track and trace (Katz and Marshall, 2018; Beneito-Montagut et al., 2022; Rosales et al., 2023). Digital inclusion is imperative for everyone in society, especially as we take a transgenerational technology approach to interactions and perspectives (Rosenberg, 2019; Sourbati and Loos, 2019; Ivan and Cutler, 2021b; Fernández-Ardèvol and Grenier, 2022). However, many people have still been excluded because they do not have the confidence to use new technologies, or there are no digital programmes available for them to upskill their digital skills and literacy (Marston et al., 2020b; Sourbati and Behrendt, 2021).

The research presented contributes to the growing body of work in the fields of social sciences, gerontology, gerontechnology, health, and wellbeing, but greater efforts are needed. Digital skills and those people who are currently and likely to be excluded, or those who have greater challenges in our society because of their physical environment—such as living in rural or remote areas—financial implications (Dow-Fleisner et al., 2022), or access to knowledge (Marston and Van Hoof, 2019), continue to be ignored. This requires more effort from scholars. We must reduce echo chambers, reinvent the wheel, and instead include a broader group of people in research activities if there will be any attempt to actually understand why people from marginalized communities do not have the digital skills or ownership of digital devices, which, in turn, would assist them to conduct alternative modes of purchasing, or to extend their learning practices relating to digital technologies and practices. This has to be rectified.

Evidence-based research can play an integral role in this process, alongside co-designing and co-producing training manuals with people, young or old. One example we can draw on is from the "Adapt Tech, Accessible Technology" (ATAT, 2020–2022) project [2020–2022], conducted by researchers in the UK, engaging with various stakeholders and older adults online through a series of workshops, which resulted in several deliverables.

Much work has been undertaken regarding the digital divide, yet the narratives continue to be purported with little tangible solutions offered. Furthermore, the imbalance in accessing digital healthcare and health professionals as well as in complimenting social care needs must be reduced if digital technologies are meant to be the solution for managing greater remote (health) monitoring (Litchfield et al., 2021). Similarly, health professionals and people undertaking educational programmes who wish to work in the health and social care professions need to acknowledge and realize the need for and role of digital technologies in our daily lives. Therefore, such educational programmes should instill curricula associated to digital technologies and practices, enabling future practitioners the knowledge (at the minimum) and skills to feel confident to use within practice and the community (Dumitru et al., 2022).

The knowledge contributed to this Research Topic can and should benefit members of the wider scholarly communities, and we hope future investigations will take note of the respective findings published throughout the different articles published here. Additionally, we hope future readers of this Research Topic will realize that continuing to work within their own

echo chambers is not conducive to the overall goals of reducing digital exclusion, enhancing digital inclusion, and actually planning for future aging populations, because Generation X and other younger cohorts have different needs and experiences of digital technologies and practices (Marston and del Carmen Miranda Duro, 2020; Loos and Ivan, 2023). Therefore, when younger generations reach later life, their expectations will differ to that of the current older population, and they will expect appropriate solutions.

Author contributions

LI: Writing—review and editing. HM: Writing—review and editing. DR: Writing—original draft. BR: Writing—original draft.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Understanding older adults' attitudes toward mobile and wearable technologies to support health and cognition

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The use of technology to facilitate remote patient monitoring and virtual care is desirable due to the challenges of providing healthcare during the COVID-19 pandemic and the need for more efficient and effective methods to care for the expanding older adult population. Further, the collection and sharing of patient generated health data (PGHD) through these technologies holds promise with respect to improving outcomes and reducing the cost of care by facilitating the early detection and treatment of cognitive and health problems. Despite the potential benefits of these technologies, their promise might be hampered by low rates of acceptance and adoption among older adults. In an online survey, we assessed community-dwelling older adults' (N=92) attitudes towards the use of wearable and mobile technologies for (1) predicting cognitive decline, (2) assisting with adherence to healthy activities, and (3) collecting self-report data to understand current and predict future health states. Participants generally agreed hypothetical technology solutions would be useful (M=4.20, SD=0.70 on a 1–5 agreement scale; 5="strongly agree"), that they were interested in learning more about these technologies (M=4.04, SD=0.74), and that they would be willing to adopt these technologies (M=3.83, SD=0.93), though attitudes varied. Although participants were generally positive toward these technologies, they were relatively neutral in terms of their agreement that privacy of generated data was a concern (M=2.92, SD=1.02). Privacy concerns were associated with lower interest and willingness to adopt. More positive general technology attitudes and higher mobile device proficiency were associated with greater acceptance and willingness to adopt these technologies. Finally, poorer self-rated health was related to negative attitudes toward these technologies. These findings highlight barriers and potential targets for intervention to increase uptake of these and similar technologies among older adults who may be reluctant to adopt remote monitoring technologies.

KEYWORDS

technology acceptance, technology adoption, telehealth, remote monitoring, aging, digital divide

Introduction

The use of technologies that facilitate remote patient monitoring and care has increased substantially over the past few years in the United States, with analyses suggesting that telehealth usage increased approximately 38 times from usage observed during the early part of the year 2020 (Bestsennyy et al., 2021). The challenges of providing healthcare during the COVID-19 pandemic and the need for more efficient and effective methods to care for the rapidly aging population have accelerated this trend (Hoffman, 2020; Hosseinzadeh et al., 2020; Schulz et al., 2022). Mobile and wearable technologies specifically have the potential to support the early detection of, and intervention for, a variety of age-related health conditions by continuously monitoring health and cognitive status through actively or passively produced patient generated health data (PGHD) (Kim et al., 2021). Actively generated PGHD, including health survey data, patient reported outcome measures (PROMS), and other types of patient initiated sharing of health information can facilitate timely and actionable health decisions (Jayakumar et al., 2020). Passively collected PGHD obtained *via* patients' interactions with devices (e.g., wearables) generate digital phenotypes and biomarkers that can provide additional insights into disease trends and alert providers about the need to take action to prevent poor outcomes (Jayakumar et al., 2020; Waring and Majumder, 2020; Milne et al., 2022). However, the fulfillment of these promises is contingent upon the willingness of patients to share their personally sourced data with health providers for use in assessing their health and cognitive status to help prevent future problems. Privacy and security concerns related to the sharing of health data are potential barriers for older adults (e.g., Fischer et al., 2014; Young et al., 2014), and as will be expanded upon later, adoption and adherence to such technologies to track and share health data might be strongly influenced by age-related differences in technology adoption and proficiency.

Despite the potential benefits of wearable and mobile devices to support older adults' health and cognition, older adults may face particular barriers in using and adopting these devices, diminishing the potential of these technologies to support healthy aging (e.g., Preusse et al., 2017; Lazaro et al., 2020; Chandrasekaran et al., 2021). This fact is consistent with a still persistent "digital divide" in the United States and around the world, for example in the United States about 25% of older adults (65+) are not online, and approximately 40% do not own a smartphone, compared to near universal adoption and ownership of these technologies among younger adults (Pew Research Center, 2022). The digital divide became especially salient during the COVID-19 pandemic as many vital services, including healthcare services, were shifted online (Xie et al., 2020). Across the literature, however, there is limited knowledge about older adults' willingness to collect their health-related data from wearable and mobile devices and share this data with healthcare providers (Farivar et al., 2020; Chandrasekaran et al., 2021). Few empirical studies have assessed the attitudes of older adults toward collecting and using their digital data to measure and predict their health and cognitive status, specifically. To facilitate the collection of these data among the older adult population, it is important to understand older adults' attitudes. It is also important to understand how individual difference characteristics might affect their perceptions.

Models of technology acceptance such as the Technology Acceptance Model (TAM), the Senior Technology Acceptance Model (STAM), and the Unified Theory of Acceptance and Use of Technology (UTAUT) have endeavored to help elucidate the factors that contribute to technology acceptance, providing clues as to factors to target to facilitate adoption (Davis, 1989; Venkatesh et al., 2003; Chen and Chan, 2014; Charness and Boot, 2016; Mitzner et al., 2019). Two key predictors of technology acceptance across these models, including models developed specifically to explain the adoption of technology among older adults, are *perceived usefulness* and *perceived ease of use* of the technology. According to the original definitions provided by Davis (1989), perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance." Perceived ease of use refers to "the degree to which a person believes that using a particular system would be free of effort." More generally, perceived usefulness refers to the anticipated benefit a technology has to achieve a goal (e.g., maintaining health and cognition), and perceived ease of use refers to whether an individual anticipates use of the technology will be easy compared to difficult. Other identified factors include age, level of education, income level, race/ethnicity, gender, prior experience with technology, and self-efficacy (Davis, 1989; Mitzner et al., 2019). These models, particularly The TAM and its various modifications, emphasize perceived usefulness as key to technology acceptance (Alwahaishi and Snášel, 2013). This study posits that perceived usefulness may also be influenced by the general health and cognitive status of the user, with users who are more vulnerable or who have poorer health and cognition more likely to perceive technologies to be more useful compared to their less vulnerable and healthier counterparts. This may be especially relevant to privacy concerns, as older adults may be willing to sacrifice some level of privacy to support their independence through better overall health and cognition.

The current study examined the willingness of older adults to collect their own digital data actively and passively for assessing their current health status and predicting and preventing future problems such as cognitive decline, as well as their willingness to recommend these technologies to others. The potential impact of vulnerability to health and cognitive problems on judgments was evaluated in two ways – 1) by having some participants read about hypothetical individuals who were presented as more or less susceptible to disease, and 2) by comparing participants with better and worse self-rated health and cognition. Concepts such as perceived usefulness and ease of use are anticipated to be important. It is predicted that the vulnerability of the person described in hypothetical scenarios would impact how useful participants would perceive that technology would be for them (greater vulnerability being associated with greater perceived

usefulness), resulting in more positive attitudes (similarly, participants' own health and cognitive status might influence their perceptions of the usefulness of the technology for themselves). Separately, participants' own proficiency using technology is anticipated to be important as mastery of technology is anticipated to impact perceived ease of use of technologies described.

Objectives

Study aims were (1) To assess older adults' attitude toward the use of digital phenotypic or biomarker data from wearable or mobile devices to generate health related predictions about participants' daily routine to support adherence to healthy behaviors or to predict participants' likelihood of developing future health or cognitive problems, (2) To assess older adults' attitude toward the use of wearable or mobile technologies such as smartwatches or smartphones to collect participants' health related surveys that can be shared with health care providers, and (3) To determine whether health vulnerability has an effect on older adults' perceptions of these technologies. We hypothesized that older adults would be more positive toward these technologies if the person described in the scenario was described as more vulnerable to health, cognitive, or adherence challenges.

Materials and methods

Participants

Data were collected from older adults who were members of Florida State University's Institute for Successful Longevity's participant registry.[1] This registry contains contact information of over 2,500 older adults (age 60 or older) who expressed interest in being study volunteers by responding to an advertisement campaign that included newspaper advertisements, community outreach, and direct mailings. Registry members live in Tallahassee, Florida, or the surrounding region.

Our goal was to obtain responses from approximately 100 individuals. Although this goal was based primarily on study resources, even with some attrition and missing data, the planned sample size was powered to detect at least a medium-sized association ($r = 0.30$) between individual difference characteristics and self-reported attitudes toward the described technologies (alpha = 0.05, power = 0.80), and could detect a medium-large effect ($f = 0.325$) of vulnerability on attitudes (between participant factor) in a two-group ANOVA (Faul et al., 2007).

An email asking for participation in the survey study was sent to approximately 500 individuals in the registry (in two batches of 250) assuming a response rate of approximately 20%. This list of 500 older adults was generated randomly by the Institute for Successful Longevity. Individuals who completed the survey were entered into a raffle to win one of two $50 gift certificates. Of the 108 older adults who initially started the survey, 92 participants completed all survey sections. Their average age was 71.23 years ($SD = 4.44$), and the sample was 59% female. Due to the volunteer nature of the sample and the demographics of the registry, the sample was largely from a high socioeconomic status background. The sample was mostly white and non-Hispanic (92%), most reported an income of $60,000 or more (80%), and most had a bachelor's degree or higher (78%).

Materials

The survey was administered using the Qualtrics survey platform, and contained the following sections in order:

Health technology scenarios

Participants were presented with three hypothetical health technology scenarios (See Supplemental materials). Scenario 1 asked participants to consider a smartwatch capable of predicting future cognitive decline. Scenario 2 asked participants to consider a smartwatch capable of supporting healthy behaviors by providing reminders based on machine learning predictions of when the wearer of the watch would be most available to engage in the health behaviors. Scenario 3 asked participants to consider a health survey platform administered *via* smartphone that would allow for the diagnosis of current health problems and prediction of future health problems. Half of all participants received information to suggest the person in the hypothetical scenario was vulnerable or susceptible to a health problem relevant to the technology under discussion (e.g., for the smartwatch to predict cognitive decline: "Cindy is a 65-year-old woman" vs. "Cindy is a 65-year-old woman with a family history of Alzheimer's disease").

For each technology scenario, participants were asked whether they agreed with statements that 1) the technology would be useful to the person described in the scenario (Useful), 2) they would recommend the technology to the person described in the scenario (Recommend), 3) the person in the scenario should be concerned about their privacy when using the technology (Privacy Concern), 4) the participant themself was interested in learning more about the technology (Interested), and 5) the participant themselves would consider adopting the described technology (Adopt). A Likert scale was presented with the following options; (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Strongly Agree.

Mobile device proficiency questionnaire

The MDPQ was administered to understand whether technology proficiency is associated with attitudes toward wearable and mobile technologies to promote physical and cognitive health. The abbreviated (16 item) version of the MDPQ was administered which asked participants to rate their proficiency using mobile devices, including smartphones and

1 https://isl.fsu.edu/

tablet computers (e.g., "Using a mobile device I can: Send emails"). This measure has demonstrated validity and reliability (Roque and Boot, 2018; Moret-Tatay et al., 2019; Petrovcic et al., 2019). The measure consists of eight subscales (subscale scores range from 1 to 5 with lower numbers representing lower proficiency). As the short form was used here, each subscale featured two questions which are averaged to produce a subscale score according to the published scoring scheme. Total MDPQ scores are generated by adding all subscales, producing scores that from 8 (lowest proficiency across all subscales) to 40 (highest proficiency).

Technology readiness index

The TRI (Parasuraman and Colby, 2014) was administered to understand whether general attitudes toward technology can predict specific attitudes toward wearable and mobile devices to promote physical and cognitive health. The TRI features 16-items and subscales (4 questions each) include technology optimism, innovativeness, discomfort, and insecurity. Technology optimism and innovativeness are scales that represent positive attitudes toward technology, and technology discomfort and insecurity capture negative attitudes. For the current study, total TRI score (an average of subscale scores after reverse coding negative questions) was used with scores ranging from 1 (negative attitudes) to 5 (positive attitudes).

Health literacy

Health literacy was another predictor included to understand attitudes toward these health technologies. A brief health literacy measure (3 items) assessed difficulty learning about medical conditions, interpreting medical information, and filling out medical forms (Chew et al., 2004). Participants were asked about the frequency with which difficulties in these domains occurred, from Never (1) to Always (5). Participants who did not report a 3 or above on any question were classified as having high health literacy.

Health status

Five questions from the SF-36 assessed health, including questions about general health, chronic diseases, bodily pain, and physical limitations (Brazier et al., 1992). For analysis purposes, however, the general health question (In general, would you say your health is: poor, fair, good, very good, excellent) was used to represent global health given that this question has been found to be as valid, reliable, and sensitive as multi-item scales (Macias et al., 2015) and has been found to be comparable with longer instruments in terms of predicting important health outcomes such as healthcare utilization, hospitalization, and mortality (DeSalvo et al., 2005).

Cognitive health

A five-item Perceived Deficits Questionnaire [PDQ-5; adapted from (Sullivan et al., 1990)] was used to assess participants' cognitive health. Participants were asked to rate how often in the past 4 weeks they had encountered problems with memory, attention, or concentration from 0 = Never to 4 = Almost always. Answers were summed to produce a score from 0 (low cognitive deficits) to 20 (high cognitive deficits).

Demographics.

Finally, a brief demographics survey asked participants about their birth year, gender (male: 1; female: −1), race (White: 1; Black or African American: 2; American Indian or Alaska Native: 3; Asian: 4; Native Hawaiian or Pacific Islander: 5; Other: 6; Prefer not to answer: 7), ethnicity (Spanish/Hispanic/Latino: 1; Non-Spanish/Hispanic/Latino: 2), education (<High School: 1; High School/GED: 2; Some College: 3; Associates or Technical Degree: 4; Bachelor's: 5; Graduate or Professional Degree: 6; Prefer Not to Say: 7), and income (Less than $10,000: 1; $10,000–$19,999: 2; $20,000–$39,999: 3; $40,000–$59,999: 4; $60,000–$79,999: 5; $80,000 or more: 6; Do not know for certain: 7; Do not wish to answer: 8). Birth year was used to calculate an approximate Age variable. For analysis purposes, a Race/Ethnicity variable was created in which White Non-Hispanic individuals were coded as 0, and all other participants were coded as 1. A High Income variable was coded such that individuals reporting an income of $60 K or greater were coded as 1 (less than $60 K as 0). A High Education variable was coded such that individuals earning a Bachelor's Degree or higher were coded as 1 (less than Bachelor's 0). If participants selected responses such as "Prefer not to answer," "Do not know for certain," or "Do not wish to answer," these responses were coded as missing data and excluded from reported analyses.

Procedures

Data collection occurred during April and May of 2022. Emails were sent to individuals within the ISL participant registry with an explanation of the study and link to the survey instrument. After indicating consent to participate within the survey, participants completed the survey instruments in the above order. Qualtrics alternated survey version such that half of the sample received a version of the technology scenarios with no information about the person described in the scenario other than their name, gender, and age, and half received additional information related to their increased vulnerability to health challenges. After completing the survey, participants were directed to a link to a separate Qualtrics form in which they could provide their contact information to be entered into the gift certificate raffle.

Results

Participant attitudes toward technologies

Participants were asked about their attitudes toward (1) a smartwatch to predict future cognitive decline, (2) a smartwatch to support adherence to healthy behaviors, and (3) a smartphone app to collect health information to assist with disease diagnosis and the prediction of future health problems. Although we predicted

that participants would be more positive toward these technologies and less concerned about privacy when scenarios featured individuals with greater disease vulnerability or susceptibility, initial analyses provided little evidence for this hypothesis.

Of initial interest was agreement responses related to questions asked of each scenario. These data were entered into an ANOVA with scenario (Cognition, Adherence, Health) and question (Useful, Recommend, Privacy, Interest, Adoption) as within-participant factors, and vulnerability (Not Vulnerable vs. Vulnerable) as a between-participant factor revealed no main effect of vulnerability ($F(1, 87) = 0.033$, $p = 0.857$, $\eta_p^2 = 0.027$). Nor did vulnerability interact with scenario, question, or both scenario and question (all p values >0.31). This primary planned analysis was supplemented with a MANOVA conducted on participants' responses to the 15 questions across three scenarios with vulnerability as a between-participant factor. Again, no hint of a vulnerability effect was observed (Wilks' $\Lambda = 0.839$, $p = 0.534$). As a result, we collapsed data across vulnerability category. Collapsed data are presented in Figure 1.

Usefulness

As can be seen from Figure 1, participants rated all technology solutions as well above neutral (3) in terms of usefulness to the individual described in the scenario. Participants did not rate any technology as significantly more useful than another ($F(2,182) = 2.499$, $p = 0.085$, $\eta_p^2 = 0.009$).

Recommend

Participants rated all technology solutions as well above neutral (3) in terms of recommending the use of the technology to the individual described in the scenario. Ratings differed between technologies (Figure 1; $F(2,180) = 5.405$, $p < 0.01$; $\eta_p^2 = 0.014$). Contrasts found that participants demonstrated a stronger preference to recommend the app to support health ($M = 4.17$, $SD = 0.82$) over the smartwatch to predict cognitive decline ($M = 3.91$, $SD = 0.90$; $p < 0.01$, Cohen's $d = 0.34$; Bonferroni correction).

Privacy concerns

Participants generally neither agreed nor disagreed that individuals described should have privacy concerns when using these three pieces of technology (Figure 1). Responses were close to "neutral" for all technologies, though there were significant differences as a function of technology type ($F(2,182) = 3.599$, $p < 0.05$; $\eta_p^2 = 0.006$). This was driven by more privacy concerns for assessing cognition compared ($M = 3.02$, $SD = 1.09$) to supporting adherence ($M = 2.80$, $SD = 1.08$; $p < 0.01$, Cohen's $d = 0.38$; Bonferroni correction).

Interest

Participants were above neutral, on average, in their interest in learning more about these three different technologies to support cognition, adherence, and health. Interest did not differ based on technology type (Figure 1; $F(2,180) = 2.48$, $p = 0.086$; $\eta_p^2 = 0.008$).

Adoption

Participants were generally positive (above neutral) in terms of considering adoption of the technologies themselves. Attitudes differed significantly between technologies (Figure 1;

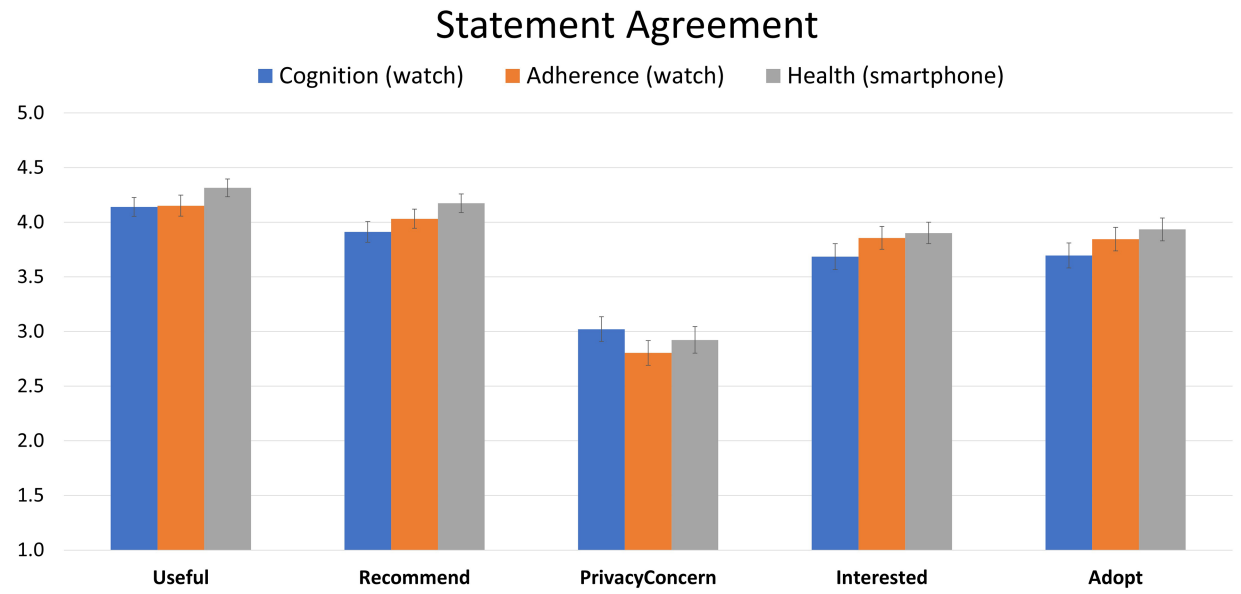

FIGURE 1
Average participant responses related to three different hypothetical technologies to support cognition, adherence, and overall health. Error bars represent +/- 1 SEM.

$F(2,180) = 4.219$, $p < 0.05$; $\eta_p^2 = 0.009$). Participants were more positive with respect to adoption for the technology to support health ($M = 3.93$, $SD = 1.00$) over cognition ($M = 3.70$, $SD = 1.10$; $p < 0.05$, Cohen's $d = 0.24$; Bonferroni correction).

Associations with attitudes toward technologies to support health and cognition

Next, we examined factors that correlate with participants' attitudes toward these technologies. To simplify analyses, all questions regarding hypothetical technology scenarios were entered into a Principal Components Analysis (PCA). A two-factor solution (using Varimax Rotation) was found, explaining 67% of observed variance. All privacy concerns loaded onto one factor. Attitudes regarding technology usefulness, interest, whether participants would recommend the technology, and whether they would consider adopting the technology themselves loaded onto another factor. Here, we label these factors as Privacy Concerns and Positive Attitudes with respect to the use of mobile and wearable technologies to support health and cognition.

Relations among variables

Table 1 represents Pearson correlations among main variables of interest. A few significant relationships are of note. First, no variables appeared associated with privacy concerns related to the described technologies. However, more positive general attitudes toward technology (as measured by the Tech Readiness Index) and higher technology proficiency (as measured by the Mobile Device Proficiency Questionnaire) were associated with more positive technology attitudes toward the technologies to support health and cognition. Also, contrary to expectations, poorer health was associated with less positive attitudes toward the described technologies.

Table 2 presents Pearson correlations among the five attitudinal dimensions associated with each technology depicted in Figure 1. A few relationships are of note. Not surprisingly, a strong positive association was observed between participants' interest in the described technologies and their willingness to adopt them. Perceived usefulness also correlated strongly with participants' willingness to adopt. Perceptions of usefulness and interest also correlated with participants' likelihood of recommending the technologies to others. Finally, negative associations (though weaker) were observed between privacy concerns and interest and willingness to adopt, as well as participants' ratings of usefulness of the described technologies and whether participants would recommend these technologies to others.

Conclusion

Older adults adopt newer technologies at a slower rate compared to younger adults, and this can impact the adoption and use of healthcare technologies that might facilitate the detection of, and intervention for, age-related cognitive and health problems. However, the potential of these technologies for improving the health and independence of older adults depends crucially on adoption by older adults, which depends on willingness to adopt. This study examined older adults' attitudes toward, and willingness to, adopt three different healthcare technologies to support health, cognition, and adherence to healthy behaviors. Remote monitoring technologies and their benefits can provide crucial solutions to the challenges of population aging and deliver efficient and effective healthcare during times of pandemic.

The main finding was that older adults, on average, had more positive than negative attitudes toward all three health-supporting technologies (however, this conclusion must be interpreted considering study limitations described later). This included agreeing that described technologies would be useful, that they would recommend the technologies to others, that they would be interested in learning more about each technology, and that they would consider adopting the technologies themselves. Positive attitudes contradict stereotypes that older adults are generally unwilling or afraid to use technology (Mitzner et al.,

TABLE 1 Relations among variables.

	Positive attitudes	Privacy concerns	Mobile device proficiency	Technology readiness	Health literacy	Health	Cognitive deficits	Age	Gender
Positive attitudes	—								
Privacy concerns	0.000	—							
Mobile device proficiency	**0.223***	−0.101	—						
Technology readiness	**0.494*** **	−0.183	**0.615*** **	—					
Health literacy	0.004	0.001	0.190	0.189	—				
Health	**0.335****	−0.053	−0.035	−0.012	0.160	—			
Cognitive deficits	0.047	0.029	**−0.239***	**−0.253***	**−0.255***	−0.141	—		
Age	−0.013	−0.007	−0.191	−0.201	−0.124	−0.080	0.105	—	
Gender	0.039	0.183	−0.196	−0.155	**−0.329****	−0.006	0.179	0.144	—

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. Significant relationships are depicted using bolding.

TABLE 2 Relations among 5 primary outcomes.

	Useful	Recommend	Privacy concern	Interested	Adopt
Useful	—				
Recommend	0.895***	—			
Privacy concern	−0.316**	−0.290**	—		
Interested	0.654***	0.658***	−0.277**	—	
Adopt	0.766***	0.789***	−0.299**	0.904***	—

**$p < 0.01$, ***$p < 0.001$.

2010). When asked about whether data privacy should be a concern, participants' responses were neutral, suggesting that they were not unconcerned about privacy issues, but also, not strongly concerned either. More nuanced and detailed questions about privacy might help unpack specific concerns and how these concerns impact adoption of these technologies.

Contrary to expectations, participants who read scenarios featuring individuals described as more vulnerable did not rate the described technologies as more useful, nor did they indicate less concern about data privacy. We anticipated that poorer health would enhance perceived usefulness of such technologies. Admittedly, this was a subtle manipulation, and it is possible that descriptions that made vulnerability more salient could have had an impact on participants' ratings. Further, contrary to predictions, poorer health and cognition was not associated with more positive attitudes. In fact, poor overall health was associated with more negative attitudes toward these technologies. This finding is congruent with a recent, large-scale national survey in the United States finding that individuals with poorer health were less likely to use wearable health devices (Chandrasekaran et al., 2020). This finding is inconsistent, however, with the Senior Technology Acceptance Model (STAM) which predicts that individuals with poorer health are more likely to use technology to compensate for health limitations. However, associations may be different when considering health in relation to usage behaviors compared to attitudes, and general technology use compared to the specific technologies described in our hypothetical scenarios.

An important goal for researchers in this area is to develop interventions to reduce the age-related digital divide (Charness and Boot, 2022). Our study suggests a few important factors to target to help promote adoption. Positive attitudes toward adoption were predicted both by mobile device proficiency and general attitudes toward technology. These specific factors might be targeted through intervention to help promote adoption of health technologies like the ones described here. With respect to general attitudes toward technology, it is important to recognize that attitudes may not improve spontaneously over time (Lee et al., 2019). However, structural equation modeling of a large data set has suggested that enhancing technology proficiency can result in more positive attitudes, facilitating technology adoption and use (Czaja et al., 2006). Technology training interventions should be developed to target proficiency. Technology proficiency and familiarity likely impacts perceived ease of use, a critical factor related to intention to adopt new technologies according to several models of technology acceptance and adoption (e.g., Davis, 1989; Venkatesh et al., 2003; Chen and Chan, 2014). However, like technologies themselves, the design of instructional support and training programs to enhance proficiency should also consider the needs, preferences, and abilities of older adults (Czaja and Sharit, 2012; Cotten et al., 2016). It would be beneficial if this training could also account for individual differences in initial technology proficiency (Roque and Boot, 2018).

Privacy concerns were correlated with intention to adopt described technologies. This is consistent with the Extended Unified Theory of Acceptance and Use of Technology (UTAUT) model (Cimperman et al., 2016), which used questions like "I would feel totally safe providing sensitive personal information about myself over the Internet" to assess the construct of perceived security. Specifically, it was found that perceived security of data was an important predictor of behavioral intention to adopt telehealth solutions. Based on our findings, interventions might help address these concerns through education. Designers of these technologies should pay careful attention too to data privacy to help alleviate concerns.

These results, however, need to be interpreted considering several study limitations. The primary limitation was a sample that was mostly of high socioeconomic status (SES), and who answered surveys *via* an email (technology-based) invitation. This likely provided an overestimate of the broader population of older adults' positive attitudes toward these technologies. Though, with 75% of older adults online in the United States at this point (Pew Research Center, 2022), our sample may not have been entirely unrepresentative of older adults in the United States with respect to technology experience. Also, older adults in our study were community dwelling, likely with few limitations of instrumental activities of daily living, and were generally of good physical and cognitive health. Because of a limited range of health and cognitive status scores, our results may have underestimated the importance of these variables in predicting attitudes among the broader population of older adults.

As with all survey studies, we had to balance the amount of information gathered from each participant (i.e., number of questions) with participant burden. First, the sample size was relatively small and did not allow for multivariate analyses. Further, we chose to prioritize concepts such as technology proficiency, general technology attitudes, health, and cognition. However, it should be acknowledged that other demographic variables (e.g., marital status, living context) and experiential variables (technology device ownership, previous device use) may also play critical roles in shaping adoption, use, and attitudes toward technology. Further,

given the brief nature of the survey and scenarios described, we did not describe and evaluate participants' responses to specific privacy and data security issues, or explore these issues in depth. Focus group studies are planned to provide a more nuanced and comprehensive review of these issues based on the results of this survey study. Finally, our data captured one snapshot in time; *change* in health status may be a particularly important factor to consider with respect to attitudes toward health technologies.

Despite these limitations, however, our results provide some initial insights into older adults' attitudes toward novel health technologies and barriers to adoption. These insights have the potential to shape interventions to help ensure that useful technologies are widely adopted, providing benefits to the individual and to society. Future studies should examine these questions in larger, more diverse samples to provide additional insights, assess usage rather than behavioral intention, and focus groups have the potential to provide a more nuanced, qualitative understanding of barriers and facilitators related to adoption. For example, a planned focus group study of older adults with and without mild cognitive impairment (MCI) will present these same scenarios to participants to better understand perceived technology benefits, specific privacy concerns, and other attitudinal barriers and concerns not assessed in the current study, and whether these barriers and concerns might differ between participants who are more vulnerable (MCI participants) or less vulnerable to further health and cognitive decline. As part of a larger technology-based clinical trial examining adherence to home-based cognitive assessment, we also plan to have a subset of participants wear a smartwatch for multiple months to better understand factors related to not just intention, but actual usage.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by Florida State University Institutional Review Board. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

IF conceptualized this study, coded surveys into Qualtric, conducted data analyses, and completed the first draft of this manuscript. WB obtained ethical approval, assisted with data analysis, and revision of the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1036092/full#supplementary-material

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Life after lockdown: The experiences of older adults in a contactless digital world

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Introduction: The digital response to the Coronavirus (COVID-19) pandemic and its effects on the lives of older adults has been well-documented, but less is known about how they experienced the post-lockdown re-emergence into a relatively contactless digital society.

Methods: We report the findings from a qualitative survey ($n = 93$) and subsequent interviews ($n = 9$) with older adults aged 50+, where they describe their struggles with some of the newly implemented digital interactions. These struggles cover a range of settings but include using contactless payments, QR codes and apps to facilitate transactions in cafes, bars, and restaurants.

Results: A thematic analysis of our data revealed the intrinsic (e.g. digital literacy) and extrinsic (e.g. malfunctioning technology) factors that limited social inclusion for these participants, and that sometimes even led to moments of public humiliation.

Discussion: Our findings shed light on some of the motivational factors that underpin the age-related digital divide, whilst also highlighting the role of self-directed agism in limiting motivations to learn new digital routines.

KEYWORDS

aging, older adults, technology, COVID-19, digital exclusion, digital divide

1. Introduction

The Coronavirus (COVID-19) crisis was accompanied by a rapid digital revolution. Within the home, lockdown periods triggered a move to working from home and homeschooling, placing a new digital burden on families (Shek, 2021), while social activities with friends and family moved online (Hantrais et al., 2021; Shek, 2021). Outside of the home, contactless technology became ubiquitous, with a major growth in cashless and touchless interactions *via* smartcards, smartphones, QR codes, or other forms of seamless digital exchange (Huterska et al., 2021; Iqbal and Campbell, 2021). In many countries, there was a mass rollout of apps and digital certificates designed to control the spread of COVID-19 by restricting access to those who were not vaccinated or issuing digital notifications for individuals who had come into close physical contact with those who were infected. In short, there was a mass "digital first" response to many of the problems created by the pandemic,

but this also meant that many existing digital inequalities were exacerbated, with older adults, ethnic minorities, the disabled, and those of lower socioeconomic means particularly disadvantaged (Hantrais and Letablier, 2020; Litchfield et al., 2021; Nguyen et al., 2021; Poole et al., 2021).

Older adults faced significant challenges during this period. Firstly, they were more likely to experience serious health consequences if exposed to COVID-19. Secondly, COVID-19 became seen as the "older adult problem" with older adults sometimes vilified by those objecting to social distancing measures (Lichtenstein, 2021), while the most vulnerable were asked to shelter indoors for long periods (Fraser et al., 2020). Many older adults struggled as people turned to digital means to stay in touch with friends (Haase et al., 2021), shop for food and basic necessities (Palmer et al., 2021), and access healthcare (Choi et al., 2022). Some already had the requisite digital skills and others quickly acquired them (Xie et al., 2020; Kim et al., 2022); however, many others faced what Seifert et al. (2021) called the "double burden of social and digital exclusion." Although defining older adulthood remains difficult for a number of reasons, here we refer to older adults as those aged 50+, in line with existing literature (Rader and Wash, 2015), including a more inclusive age bound allows for a greater likelihood of diversity in our older adult sample.

As lockdowns eased, people were once again able to go out and about in society, but the rapid rise in contactless digital interactions brought challenges for many older people (Kotkowski and Polasik, 2021). Cash transactions were discouraged, paper menus had all but disappeared, and QR codes became ubiquitous; not only for COVID-related "checking in" processes in the hospitality industry, but also for digital (and therefore socially distant) communication with waiters, etc. Little is known about the experiences of older people during this period of emergence from lockdown, but it is possible that further social and digital inequities were propagated at this time, and that is the focus of the present study.

We explored the experiences of older adults in this increasingly contactless digital world, asking questions about the particular challenges they faced and about how they dealt with these challenges. In doing so, we learned something distinctive about the factors that make people experience exclusion as an acute phenomenon and noted the ways this could drive behavior change around technology use. Specifically, in our study, and in the literature below, we ask to what extent the rapid digital changes made following lockdown periods disadvantaged some older adults, how this disadvantage was experienced, and whether this experience influenced their desire to acquire new digital devices and skills.

2. Background literature

2.1. Older adults and the digital divide

There has been much discussion about the digital divide and the existence of a "digital underclass" (Helsper and Reisdorf, 2017), referring to groups of citizens who have a limited digital voice and limited access to online services. Older adults are one demographic that risk falling into this underclass, often exhibiting the "three levels" of digital deprivation: limited or no Internet access, low digital literacy, and relatively poor agency when engaged online, resulting in adverse offline consequences (van Deursen and Helsper, 2015; Schreurs et al., 2017; Hunsaker and Hargittai, 2018; van Deursen and van Dijk, 2019).

A number of initiatives have been designed to promote higher levels of digital inclusion (Reisdorf and Rhinesmith, 2020) by improving digital literacy (Radovanović et al., 2020) and offering greater social support (Asmar et al., 2020). Despite this, digital inequalities remain pernicious: particularly in the older adult community. Recently, researchers have begun to ask whether this is necessarily an *inequality* problem relating to digital access and/or skills, or a matter of *informed choice*, given that many older adults have expressed the view that they are content to live their lives offline, challenging the prevailing view that Internet access inevitably delivers benefits, and that poor access has adverse consequences (Scheerder et al., 2017). Put simply, researchers have recognized that some individuals simply do not wish to go online and see no advantage in doing so (e.g., Wyatt, 2003; Satchell and Dourish, 2009; Page et al., 2018), while others have a limited online presence, but see no need to improve their basic skills (Bardach et al., 2021). In other words, there are strong motivational reasons that can explain the limited use of digital technologies which go beyond access and literacy barriers. This distinction is important in our work, as the COVID-19 pandemic has arguably transformed the motivational grounds for digital non-use, given the sudden removal of much of the physical and social fabric of everyday living. If friends can no longer drop by, or businesses no longer accept cash payments, then surely the benefits of online interaction begin to outweigh the costs, even for those individuals who had previously eschewed online activity.

Mossberger et al. (2015) noted that technologies cannot be separated from the social systems and processes within which they are embedded, and that motivations to go online will inevitably depend upon the extent to which digital access can determine one's ability to fully participate in society. Helsper (2017) takes this further, arguing that some of the motivational factors underlying the digital divide can be best explained by Relative Deprivation Theory, an established theory that argues a more nuanced and relative understanding of "deprivation" in terms of people's subjective assessment of their own personal circumstances. The theory suggests that relative disadvantage exists when people perceive themselves to be (unjustifiably) disadvantaged or different in comparison to others in a certain situation. Helsper argues that this idea should be central when understanding digital inequalities because people will only feel that they need to become digitally active when this feeling of being unjustifiably disadvantaged becomes prominent. The decision to disengage from digital life can also be self-perpetuating, i.e., a number of recent studies have shown that a form of self-directed agism can emerge, whereby people come to believe that they are simply too old to learn new digital skills (Kottl and Mannheim, 2021).

2.2. Digital challenges for older adults during the COVID-19 pandemic

During the COVID-19 pandemic, older adults found themselves particularly disadvantaged: experiencing the 'triple jeopardy' of being (1) more likely to develop serious conditions and experience higher mortality; (2) less likely to obtain high-quality information or services online; and (3) more likely to experience social isolation and loneliness (Xie et al., 2020). They struggled to get good access to digital healthcare (Litchfield et al., 2021) and were less likely to book healthcare appointments online or to access online banking (Centre for Ageing Better, 2020). They were also less likely to use digital forms of communication (video calls, text messaging, social media, and online games) to compensate for the restrictions of social distancing and lockdown (Nguyen et al., 2021), with only 20% of those aged 65 and older participating in online social gatherings with friends or family (Vogels, 2020).

In purely demographic terms, the situation for older adults was bleak: a situation compounded by the fact that older adults were vilified for their vulnerability, and a new form of agism appeared as people began to feel that lockdown restrictions were only needed to protect the old, perhaps most clearly signaled by the widespread use of the Twitter hashtag #BoomerRemover (Fraser et al., 2020). Yet, despite these challenges, there was also a sense that older people displayed great resilience during this time, possibly able to draw upon a richer set of life experiences to make sense of the changing landscape (McKinlay et al., 2021) and able to resign themselves more easily to the social restrictions that frustrated younger people (Lebrasseur et al., 2021).

The extant qualitative literature provides a more nuanced view of the lived experience of older adults during that time, and offers a rich source of information about the ways that older adults responded to the pandemic. For example, Mikal et al. (2021) followed 22 older adults for 6 weeks during the pandemic, using longitudinal qualitative surveys as a means to study digital engagement and mental health outcomes. They found that older adults effectively used social media for entertainment and education, but were less comfortable accessing online resources, and struggled with larger social media communities, preferring one-to-one communication. Talbot and Briggs (2022) interviewed 19 older adults with mild-to-moderate dementia, noting that most participants could use digital means to combat the stresses of the pandemic. Many used video and social media to boost connectedness, while some engaged in digital volunteering and/or used the Internet to acquire new skills; however, these activities were sometimes mentally exhausting for this particular group. Perhaps most telling, Fuller et al. (2022) interviewed 76 older adults aged 70–97 and found a notable difference in technology use dependent upon both age and attitude. Those in their 70s and early 80s were more willing to use video-technology to keep up with friends and family, but across all ages, there were some people who consistently reported reluctance to use digital means. The authors noted that "*many indicated a decisive and firm commitment to not adapting new technologies at their age, even if they could imagine the benefits,*" with some finding it too challenging, and systems such as Zoom seen as simply too much of a hassle.

Lebrasseur et al. (2021), in their rapid review of the experiences of older adults dealing with COVID-19, noted that it was difficult to treat older people as a homogeneous group, as their individual circumstances varied enormously. Some of the most vulnerable found themselves isolated, yet reliant upon others to deliver basic necessities. Others, however, were able to shop, socialize, or gain medical attention online. Clearly, there were major differences in the contexts in which older adults were asked to cope, with huge variation in both personal social networks, economic status, digital literacy, and attitude to technology use (e.g., Tabassum, 2020; Fuller et al., 2022), with those falling on the "wrong side of the senior digital divide" being much more likely to experience adverse effects of the pandemic (Robinson et al., 2020). In short, older adults showed great diversity in their ability to respond to digital upheaval, with some reporting positively about the transition to online activities as a means of coping (Rotenberg et al., 2021), while others doubled-down on their beliefs that technology solutions were not for them (Fuller et al., 2022).

2.3. Emerging from lockdown

One of the key things that happened following lockdown was that digital transformation moved out of the home and into the public sphere, with businesses rapidly introducing new contactless digital measures that enabled customers to buy products or services, while maintaining some form of social distance (Iqbal and Campbell, 2021). These new measures excluded those without smartphones, good connectivity, or the necessary digital skills. In other words, they excluded many of those older adults who, intentionally or unintentionally, lacked the digital means to engage. An interesting aspect of this new development was how quickly previously in-person interactions suddenly became digital. For example, on entering a restaurant, the process of being shown to a table and given a paper menu was swiftly replaced by the requirement to "check-in" *via* a QR code, and then order (and pay) online. The default, certainly in the hospitality industry, became a digital exchange *via* smartphone (Kohli and Rohtak, 2021), meaning that those who were without a smart device, or who were unfamiliar with the relevant apps and services, struggled. Critically, this struggle took place in the public sphere, while others looked on, and so our aim was to understand how such moments were experienced, what kinds of access to goods and services were denied to our older adults, and whether there were any longer-term consequences, e.g., in terms of acquiring new devices and/or digital skills.

3. Materials and methods

Ethical approval for this study was obtained from the psychology ethics board within the University of Northumbria at Newcastle on 19/10/2021.

3.1. Study design

We employed a multi-method qualitative approach, combining an online qualitative survey with online one-to-one interviews. Online, qualitative surveys are increasingly recognized as a means to generate qualitative data at scale. Braun et al. (2021) have argued that such surveys act as a "wide angle lens" on a relatively under-researched topic, ensuring sufficiently diverse voices are heard. They also noted that answers to online surveys can be brief, which is why qualitative surveys benefit from the supplementation of interviews that allow identified issues to be probed in greater depth.

3.2. Participants

The online survey was developed on Qualtrics (Qualtrics, Provo, UT, 2018) and administered to a sample *via* (Prolific, 2014) an online survey company. A soft launch of approximately 10% ($n = 10$) of the overall sample was conducted to ensure that the survey contained no errors, as well as to establish an appropriate payment for participants. The average completion time of the overall sample was just under 14 min. Participants were remunerated with £1.88 for taking part, a figure deemed "good" by prolific. In total, 128 participants accessed the survey. Of these, 93 completed the survey in full, giving a completion rate of 72.7% and a sample size in keeping with those suggested by Braun et al. (2021). Following the survey, one-to-one interviews were held with a sample of older adults ($n = 9$, 10% of survey number), giving us data for 102 participants in total. Demographics for the 93 survey participants (Table 1) and 9 interview participants (Table 2) can be seen below.

As noted above, as part of a mixed qualitative methods approach, nine further individuals (amounting to 10% of participants) were interviewed online (*via* Zoom). There were four women and five men, aged between 60 and 75. Six were married, two were single, and one was in a relationship (living separately).

3.3. Materials and procedure

In the online survey, participants were asked to recount a recent face-to-face experience where they had interacted with new, post-COVID digital interactions. Participants were informed that the research was particularly interested in negative or frustrating experiences, as although digital interactions may be positive for some, such cases are not useful when attempting to understand the possible repercussions for digital exclusion of newly implemented interactions. Participants were asked to provide a range of information including: where the interaction took place, what devices were involved, who else was involved, what happened, and how they felt about the situation. This technique of asking participants to describe a lived experience, but then prompting for detail, is recommended by Braun et al. (2021) to ensure that participants give sufficiently rich responses.

For the one-to-one interviews, participants were again invited to discuss their recent experiences of digital technology when emerging from lockdown, but with additional probing in relation to the context of their interactions. They were also asked further questions about their use of technology throughout lockdown, as well as the extent to which they felt that new systems and measures would be "here to stay." In the results section below, these participants are labeled with (I) signaling interview.

4. Analysis procedure

The experiences reported by our older adult survey sample were compiled and printed into paper format. Authors 1 and 2 (both very experienced in participatory digital work with older adults, one aged over 60) then conducted a thematic analysis in line with Braun and Clarke (2006) guidelines to identify recurring themes within the data through a process as follows. Authors 1 and 2 familiarized themselves with the data, looking in particular for vivid and compelling stories (as recommended by Braun et al., 2021). Author 1 generated the initial codes, which were then reviewed by authors 1 and 2 in a face-to-face paper-based sorting exercise. First, the authors reviewed the appropriateness of the codes in relation to the quotes, to ensure agreement that the codes were appropriately representative of the content of the experiences outlined. Codes were revised and agreed upon, where appropriate, through discourse. Following a review of the codes, the authors identified clusters of thematically similar codes, while iteratively revising groupings for the most appropriate fit. For the interview transcripts, the codes used for the survey were retained and supplemented with additional codes, initially suggested by author 3 (experienced in participatory work with older adults) but then reviewed by author 2.

5. Results

We asked for difficult experiences and overwhelmingly we were presented with detailed stories of exclusion and failure, caused by either intrinsic (personal) factors (e.g., do not have devices, do not want to use services, or do not know how to use them) or extrinsic (organizational) factors (e.g., poor quality Wi-Fi, poor usability) that impeded the success of newly implemented digital procedures. This division echoes that described by Wyatt (2003) when describing the reasons for "non-use" of technology as well as the factors identified by Morrison et al. (2021) which explain reasons for older adults' disengagement from cybersecurity practices. Essentially, here, we use the division to help elucidate the different *sources of exclusion*, which are captured in Table 3 and elaborated in the text.

TABLE 1 Demographics for online survey respondents (*n*=93).

Demographic	Descriptor	Percentage
Sex (% Ratio)	Male: 33 (35.5%) Female: 60 (64.5%) Other 0 (0%)	
Age (SD)	Mean overall: 55.63 (4.84)	
Age range	Minimum: 50 Maximum:76	
Employment status	Full time	33 (35.5%)
	Self employed	19 (20.4%)
	Part time	17 (18.3%)
	Retired	16 (17.2%)
	Unemployed/Seeking	4 (4.3%)
	Other:	
	Unable to work	2 (2.2%)
	Homemaker	2 (2.2%)
Relationship status	Married	56 (60.2%)
	Single	14 (15.1%)
	Divorced	8 (8.6%)
	Living with partner	7 (7.5%)
	Separated	4 (4.3%)
	Windowed	3 (3.2%)
	Civil partnership	1 (1.1%)
Ethnicity	White: English/Welsh/Scottish/Northern Irish/British	42 (45.2%)
	White: Any other background	28 (30.1%)
	Any other ethnic group	8 (4.3%)
	Prefer not to say	4 (4.3%)
	Black/African/Caribbean/Black British: African	2 (2.2%)
	White: Irish	2 (2.2%)
	Black/African/Caribbean/Black British: British	2 (2.2%)
	Asian/Asian British: Indian	2 (2.2%)
	Asian/Asian British: Chinese	1 (1.1%)
	Any other Asian background	1 (1.1%)
	Mixed/Multiple ethnic groups: White and Black African	1 (1.1%)
Qualifications	PhD or equivalent	5 (5.4%)
	Master's Degree or equivalent	18 (19.4%)
	Postgraduate Diploma or equivalent	9 (9.7%)
	Undergraduate Degree or equivalent	26 (28%)
	A-Level or equivalent	17 (18.3%)
	GCSE/O-Level or equivalent	12 (12.9%)
	No formal qualifications	6 (6.5%)

TABLE 2 Demographics of interview respondents.

Demographic	Detail
Age	Average: 65 (64, 67, 63, 65, 63, 61, 67, 75, 60)
Gender	5 Male, 4 Female
Living arrangement	1 lives alone, 5 live with partner only, 1 lives with friend, 1 lives with partner and two children
Ethnicity	9 White

5.1. Intrinsic (personal) sources of exclusion

It has been noted that many older adults exclude themselves from the digital world, arguing that they see no pressing need to access online resources, nor any advantage in doing so (Wyatt, 2003; Satchell and Dourish, 2009). In our data, we can see the various forms that this exclusion takes, but also note the way that

TABLE 3 Sources of exclusion in post-lockdown interactions.

Intrinsic (personal) sources	Extrinsic (Environmental) sources
Limited access to required technology (e.g., do not carry a smartphone, no Internet data)	Poor Wi-Fi access and/or mobile phone reception
Devices do not offer required functions (especially older devices)	Poor usability of forms or procedures
Reluctance to use the technology (e.g., the test and trace app)	No flexibility in procedures (e.g., no workaround if digital fails)
Limited knowledge of how to use technology (e.g., QR codes)	

personal decisions (such as not carrying a smartphone) can suddenly become problematic.

5.1.1. Limited access to required technology (e.g., does not carry a smartphone, has no Internet data)

Many post-lockdown digital innovations were designed to allow some physical access to places, goods, and services while maintaining social distance and reducing person-to-person contact. For example, bars and restaurants typically implemented a QR code system whereby menus could be sourced online, and payment could be made electronically (such as through an app or website). However, such digital interactions were not available to all. Some participants reported difficulties because they did not own or carry a smartphone:

> [24] - When I was in a restaurant, they said they could not give us menus and we were asked to scan the QR code with our phones to see the menu (we have never heard of that, so we were not prepared). My partner and I did not have our phones with us, because we wanted to disconnect. We could not see the menus, but we were not too frustrated. The situation was resolved because we both ended up ordering what the waiter recommended.
>
> [79] – [my wife] had gone to the post office to carry out some operations. Upon entering, an employee of the office asked her to show the QR code of the booking and the green pass, that is a QR code that certifies the Covid vaccination. My wife had neither and so she had to leave the office.
>
> [3i] I went to one restaurant where they wanted me to order on their QR code but when I didn't have a smartphone. They brought me their iPad to use to order. Given the whole point was Covid protection, they were happy for me to pore over their iPad but wouldn't hand out paper menus, that didn't make sense.

Although technology adoption and acceptance is steadily increasing in older adult populations (Mitzner et al., 2019), it remains lower than in other demographic groups (Paul and Spiru, 2021). As a result, many older adults still do not own their own smartphone, with a recent Pew report noting only 61% of smartphone ownership in those aged 65 and older (Faverio, 2022). For those older adults that do own smartphones, their usage is likely to be lower than younger populations (Li and Luximon, 2018; Mariano et al., 2021) and as such, they may not feel the need to always carry them. Inevitably, this meant that some of our participants had to seek help from others, asking waiters for verbal recommendations, or use alternative devices to view the menu or pay.

5.1.2. Device does not offer function

For those with smartphones, there were sometimes issues in accessing the relevant function which meant that the interactions were far from seamless. For some, having older or faulty devices led to situations where the digital interaction was not possible, or put them in situations where friends with better connectivity were successful where they failed:

> [9] - I went out to eat at a restaurant and they require you to pay via a cashless payment system called Zapper. I had to use the app on my phone which is linked to my bank card and scan the QR code printed at the bottom on the receipt. It was me and my family at the table. My camera is slightly faulty and occasionally can be blurry, therefore it was hard for me to scan the QR code. It was very embarrassing as the waiter stood closely waiting to be paid as my phone struggled to scan the code. I felt stressed and embarrassed as this is not a great situation.
>
> [38] Most negative experiences were when visiting coffee shops that had track and trace apps. The NHS app only worked for IOS above version 13 (Older iPhones such as the iPhone 6S are not capable of operating at IOS version 13 so this caused an immediate problem with using the app). The Government believe (wrongly) that everyone can afford the latest smartphone and build their app accordingly. This makes the vast majority of people unable to use the app effectively.

For others, technology failures led to refusal of entry, or frictions when attempting to enter some venues:

> [17] - The person that greeted us asked to sign covid paper and show vaccine certificate on our phones. I showed him my cert and when it was my wife's turn, she had a problem loading it in. The worker didn't let us in because we didn't have proof she was vaccinated. I felt very annoyed and frustrated because it wasn't her fault her phone didn't work.
>
> [18] – We had difficulties when checking into a hotel that required proof of a negative Covid test for myself and partner.

> We both had the NHS app, but one [of us] couldn't access it. We had the alternative of showing it from the test provider, but the email itself wasn't sufficient. We had to find the log in details for the company, and then download the result, and then forward it on by email to the hotel with a screenshot. This took over half an hour and was very frustrating.

Quite often, these protracted exchanges involved complex operations conducted on a smartphone. While it is not uncommon for younger users to use their mobile phone to make complex transactions (such as making travel arrangements), older adults are often more uncomfortable with such processes (Pangbourne et al., 2010; Jamal and Newbold, 2020).

5.1.3. Reluctance to use the technology/app

The rollout of new digital measures was rapid, and some innovations were controversial. For example, in the United Kingdom, the government recommended the universal use of the "test and trace" app that would track location and monitor for proximity to person, or persons, who later tested positive for COVID-19. While use of the app was discretionary, restaurants and bars were required to keep a record of customers and most relied on the test and trace app as a means of doing this. Unfortunately, the test and trace app was not always reliable, leading to stories of a "pingdemic" whereby citizens were told they had been in proximity with someone with COVID-19, even when this was highly unlikely. For that and other reasons, some people did not use the app, and this could lead to problems:

> [83] - On entering the restaurant … I didn't have the NHS app. I said I will leave my name and contact details which were accepted at other places, but the waiter insisted the app must be downloaded to scan the barcode. After a few minutes debating that it wasn't a legal requirement to have the app, she refused me entry to the restaurant. I felt very frustrated and peered pressured into doing something that wasn't required by guidelines and felt embarrassed being treated like this in front of customers.
>
> [106] I have been really frustrated at having to scan track and trace into restaurants, in fact I refused to have it on my phone after a bad experience. We were greatly delayed entering the restaurant as I needed to register first, the restaurant was completely empty and we sat outside at the end there was then no way to check out. Later that day someone came up positive, so we had to self-isolate even though we were there hours before!
>
> [9i] I never downloaded the track and trace … I wasn't giving my money or details to anyone in the government. But I was surrounded by people who downloaded it who were pinging all the time.

More typically, those unable or unwilling to download apps such as NHS Test and Trace faced minor inconveniences such as having to "sign in" manually to venues, something which may now be considered favorable in light of some citizens' concerns around the privacy and security implications of such applications and others (Akinbi et al., 2021; Sowmiya et al., 2021).

5.1.4. Do not know how to use the technology (digital literacy)

One participant, quoted previously, said that they had "never heard" of scanning a QR code to see a menu. This was common, with many individuals unsure of how to use the code:

> [31] - It happened at Ben and Jerry's in Vermont. There were about 20 people in line on a hot day to get ice cream. There was a QR code posted on the wall. No explanation. Just a code. Most young people know what this means and how to use it. Why would that be assumed that everyone knows how to do this? So, as I tried to figure it out, my 17-year-old was visibly and vocally embarrassed that I hit a wrong button. This, in turn, embarrassed me. It would not have taken much time to have an explanation on the code.
>
> [86] - When I entered the shopping mall, a worker of the mall asked me to use QR code by taking a picture of it with my smartphone camera. I had no idea what a QR code is or how to use it. It was not explained what it is for and I felt very stupid. By some reason it did not work (I still do not know what it was supposed to do).
>
> [6i] - We had never done it before and didn't know how to do it, we got stuck and had to call the guy over who was really busy rushing around trying to take things to people's tables. He was helpful but you thought he doesn't have time to be faffing on with old people's phones, you felt like you were a couple of dinosaurs sitting there with this young person having to show you how to use your phone.

Such observations resonate with the classic age-based view of the "digital divide" as being primarily around digital literacy (Friemel, 2016; Helsper and Reisdorf, 2017), leading to a range of digital inequalities (Hill et al., 2015; Robinson et al., 2015, 2020). What is interesting here is how a seemingly simple, but ubiquitous change (information exchange *via* a QR code) could be so divisive. In some cases, our participants acquired this new skill rapidly, but not without some initial discomfort.

5.2. Extrinsic (organizational) sources of exclusion

In many cases, our participants were unable to act because of external problems, with some of the most common issues being an inability to gain access to the Internet (because of poor Wi-Fi or phone reception), which was particularly frustrating when a restaurant or bar asked them to download a dedicated app. At

times, they were able to complete these actions, but then found usability problems when interacting with the relevant site or service.

5.2.1. Poor Wi-fi access and/or mobile phone reception

Connectivity issues were frequently reported by participants. Attempts to access vaccination certificates and company-specific apps, such as those used to order food and drinks, often failed due to a lack of mobile signal, or being outside of Wi-Fi range. At times, this led to institutions using mitigation strategies such as paper slips to track customers. Others refused citizens entry leading to them being excluded due to their lack of access.

> [67] - The pub had the NHS track and trace app outside, I do have a smart phone and I am confident with it. I scanned this several times, but nothing happened. I then realized that there wasn't a signal.
>
> [89] Arriving to the restaurant, the staff asked for both [Covid Vaccination] certificates, my Mom showed hers on paper and it was all good, but when he tried to scan my certificate with the app he had on his mobile phone, it failed, it couldn't read it and it gave an error. Therefore, we could not go inside the restaurant!

At times, the lack of connectivity led to difficult or awkward situations, especially when some members of a party were unable to access relevant apps, but others had a better phone signal, or when some struggled to use cashless means of payment.

> [19] – I met with friends at an outdoor restaurant. Needed to order using an app. Although I am confident using technology, I struggled to do it. Signal was bad, couldn't order so waiter took our order. Made me feel silly as others in our party were able to order quite easily.
>
> [54] - At Nando's the menu is via a QR code. On trying to access the QR code, I was unable to, as there was no internet access. This proved difficult to order. I was with a friend who also had the same problem.

5.2.2. Requirement to download additional apps

Participants in this study discussed several ways in which the organizations had implemented new online procedures that were particularly burdensome or time consuming. Typical of these was the requirement to download a dedicated app to access a menu, order, or pay. Again, this was a source of annoyance or awkwardness, which was exacerbated when connectivity compounded these issues.

> [34] - This situation happened in a restaurant; I was dining with my family when it was time to pay the check. I was the one paying, so I asked one of the waitresses to give me the check, I was surprised when she told me to take out my phone and open the restaurant's app. We were never told to download an app when we arrived, so I felt lost and annoyed as a result. It took me about 20 mins to pay the check and it just made me mad because if they would've told us to download the app it would've been easier and faster.
>
> [37] - I was unable to order a meal in a restaurant without the help of downloading an app to scan and read their menu. It took a while to do this and as we were older than the crowd, the waiter was helpful, but they were busy, and I could see he was in a hurry. I did feel a bit behind the times.
>
> [87] - Both me and my friend were sitting at table waiting for downloads trying to place order and work through a complex app which didn't have special dietary requirements incorporated. Felt like we wasted half an hour giving details and ordering without even speaking to each other and all within arm's length of the waitresses and a till!

5.2.3. Usability problems (text too small/ interaction poorly designed)

Failure of technology was not always the reason for difficulties using newly implemented digital interactions, however. For some users, the visual presentation of the application led to difficulties for users, this was particularly the case for those who struggle to see small content on a phone screen, something well established in older adult technology usability research (Zhou et al., 2014).

> [66] - Well, the situation occurred when a friend and I went to eat at a restaurant, and we asked about the menu, and instead of telling us the waiter what they had, he told us that we had to use the mobile and see it via QR ..., seeing the menu from the mobile, as well as the prices was desperate … so we chose the first thing we found from the menu and then we left, the truth is that you feel somewhat helpless...
>
> [59] - After waiting for a menu for a few minutes, a server came over and asked if I had decided what I wanted. I said I haven't seen a menu yet. She said we don't use them anymore … and said you have to scan the QR code with your smartphone. I was flabbergasted. With a bit of help to navigate the application on my phone, I was able to pull up the menu, but it was difficult to navigate while viewing something so small, that had to be magnified per section. I finally just ordered a standard item that I knew they would have.

In bars, restaurants, and other hospitality settings, these consequences may seem minor, such as ordering something recommended by a waiter, but as we hear below, the frustration, embarrassment, and shame experienced by many of our participants were significant.

5.2.4. Reaction to change

Earlier, we made the point that older adults are a heterogenous group, showing a range of digital skills. Many of our participants found the new procedures manageable and this reinforced their own self-image as people who are digitally competent, or as people who could adapt to new procedures where necessary:

> [56] - I am a person who is generally up to date with technology, the only thing that I had not used before was scanning QR codes, I thought it was somewhat complicated, but it ended up being easier than I thought.
>
> [1i] I don't think before COVID I had ever paid for anything with my smart phone and now I do it without thinking.

Some of our participants had long since resigned themselves to the fact that digital was "not for them." In some cases, they were simply resigned to restrict themselves to use only the most basic digital functions, living life without a smartphone or without apps. In many other cases, people had established procedures where a spouse or child was called upon to help cope with everyday digital demands and this simply continued post-lockdown.

> [4i] I can barely function. I think I do the stuff that I have to absolutely be able to do …I feel like I hang on by my fingernails.
>
> [5i] I find it's a cashless society now. I have paid with a card but Julie, my wife, if we go out, she does all of that. She swipes things if we go for a meal'.
>
> [3i] I get someone else to help me…Like most people, my wife is more adept at these things so now and again I will get her to solve the problem.

However, we did find many occasions when people were experiencing significant digital obstacles for the first time. Often, this exposure took place in a public environment, and led to our participants feeling helpless, stupid, angry, and embarrassed, sometimes resulting in a greatly reduced self-belief:

> [9i] for the first time it has felt very ageing. For the first time I felt shit, I don't know how I got to be 60, but maybe there will come a time where unless I am on top of my smart phone or apps then I will just have to stay at home and be a hermit.

Sometimes, these uncomfortable encounters became motivators for change, with people recognizing the need to acquire further digital skills or invest in a new device, something in keeping with the relational deprivation arguments outlined above; however, participants were often resentful about the need for change.

> [3i] Well, on one occasion I simply had to leave the bar… I just went to another bar that didn't do QR codes. Another time, after much persuasion, we realized we could get a drink from one of the bars but still couldn't get any food. We went somewhere else to eat. Ultimately, I went and got a smart phone.
>
> [70] - I started to feel really stressed and embarrassed about the situation. A few minutes later, someone I knew came into the store and showed me what I had to do, and thankfully it all worked OK. I felt really stupid not being able to work this out, but now I know how it all works, so it was a way of learning.
>
> [48] As a consumer I always used to buy things domestically but now I have learned to utilize online shopping. We are even forced to use phone to communicate with our doctors because of the situations. Establishments only take a limited number of people inside, for example to order food, I have been forced to get used to ordering online
>
> [95] I was forced to download the app on my phone and not knowing how to navigate the app I became very frustrated and impatient. I eventually decided to walk home and later went through the app in my own time.

There was a strong sense from these accounts that some people were being dragged screaming into a digital world. Often, the accounts were accompanied by tales of suspicion about the relative security or privacy of the apps or services involved (Elueze and Quan-Haase, 2018) and at other times, people were simply resentful of the fact that they had been forced to join the "always on, always available" generation.

> [27] - They asked me to pay by using my bank app and I didn't like it. Why? Because I'm not that good with technology so I was scared of getting robbed.
>
> [8i] People want to know too much; I don't know what it is about the modern world but this didn't used to happen. It's all about your data so if they can find out things about you, it's my information it should be up to me to decide who uses it.
>
> [3i] I never wanted to carry a phone where I could get email or Facebook and all the kinds of social areas that I work in, I didn't want to be using those. So, I just avoided putting myself in that position. Now I have a smart phone that does creep in, and I still find it annoying.

6. Discussion

Recent literature on older adults' digital literacy is characterized by the recognition that they are a highly heterogenous group and that decisions to go online are highly context dependent, i.e., not solely determined by skill level. In a

study of New York older adults, Quan-Haase et al. (2018) found a nonlinear association between skill levels and online engagement. They found that many older adults were simply prepared to "give it a go" without the requisite skills, while others became consumed with worries that digital media might overwhelm them, or simply waste their time. We found something similar in our sample, where some participants quickly embraced the changes enforced post-lockdown, whether or not they were familiar with the apps etc., while others struggled. As noted earlier, one challenging issue was the fact that these struggles often took place in a public domain. This public humiliation was seen, by some, as a reason to withdraw from technology use, while for others, it would be accepted as a challenge to be overcome. In this discussion, we unpack some of these different responses, taking the rapid need to learn new digital skills post-lockdown as our starting point, and trying to understand more about why this created a motivation to learn in some, but a desire to withdraw in others.

6.1. Too old to learn

There is a pervasive social construction of older adults as inept users of technology and many people simply feel that technology has passed them by Schreurs et al. (2017) wrote: *"Given the presence of a sometimes negative or mocking portrayal of older adults in the media, it is important for older adults to have support in obtaining digital literacy, as it would be easy to fall victim to the rhetoric that they are "inept." (Pg 373).*

Feeling "inept" or deciding that one is too old to try something is a form of "self-directed" agism (McDonough, 2020; Köttl et al., 2021) that can directly impede learning and ultimately lead to a less fulfilling life. This self-directed agism (accompanied by feelings of shame about getting older) is known to influence older adults wellbeing and quality of life and is also associated with greater cognitive decline (Kotter-Grühn et al., 2015; Bodner et al., 2021). In a number of the accounts from our participants, we heard people refer to themselves as "dinosaurs," or say they were simply "too old" to learn. Being publicly exposed as "digitally inept" however, was a particularly stigmatizing experience and was often accompanied by a sense of shame from those who internalized this label. Public failure in a digital sphere not only reinforces this social stereotype, but also taints the self-image in a way that, for some, led to the decision to stop trying. These socio-emotional aspects of digital engagement (see also Eshet-Alkalai, 2004; Haight et al., 2014) are critically important when we want to understand more about the reasons digital literacy remains a problem for many older adults. It is particularly critical when we recognize that those who wish to learn have to "expose" their poor skills to their peer network, in order to seek out friends and family who are able to help.

6.2. Willing to give it a try

It is useful to turn to those in our sample who faced, but overcame, digital exclusion to see if there may be lessons to learn here. In particular, our data may shine some light onto the so-called "digital paradox" described by Okun and Ayalon (2022) as follows: In order to learn, older adults need greater exposure to new technologies, but they are often unable to gain that exposure without the help of others. In the post-lockdown situation, we have described here that exposure was somewhat thrust upon them, and some simply did their best to cope with that. Nonetheless, we can see how important family and friends were at this point. Having access to a "warm network" of experts (see Hänninen et al., 2021) was often critical. In the data we describe, this network of individuals would sometimes be relied upon to take over, but in some of the more helpful scenarios, the warm experts were able to teach the new skills quickly and effectively. It was helpful, in these circumstances, that the people involved shared the same sense of frustration over poorly designed apps or poor-quality Wi-Fi, as this, in turn, moved the focus away from that sense of being digitally inept, into one of learning to cope with a swiftly changing world.

Though we draw a line between intrinsic and intrinsic factors in our reporting, it is important to note that in reality such factors are often intertwined, and promote, or are driven by, ongoing systemic inequalities. Recent research by Yang and Du (2021) for example, highlights how financial disparities between males and females lead to increased digital exclusion for female older adults. Having less spending power has clear connotations for digital equality (Soloman, 2002) through the ability to purchase, protect, or update technology, and with a continuing global gender pay gap (Bennedsen et al., 2019), such digital inequalities are likely to continue well into the future.

As well as generating inequalities within groups, social structures are also likely to heavily promote inequalities across demographic groups too. For example, many older adults, especially those who have worked on low incomes throughout their careers may reach retirement age without significant savings or pensions. For these individuals, the inability to buy technology may be seen as reluctance or unwillingness to conform to a digital revolution, despite the individuals' actual motivations. Such circumstances are likely to lead to promote the stigma and ageist attitudes we refer to throughout this paper.

6.3. A call to action

In the introduction, we suggested Relational Deprivation Theory (RDT) as a means of understanding some of the motivational issues that underly the digital divide. A key critical construct here is *value legitimacy*: is it acceptable that there are different outcomes for different individuals and that the resulting unequal distribution of resources is legitimate (Davis, 1959; Janmaat, 2013)? This question becomes particularly interesting when the landscape suddenly changes and when new inequalities emerge. We know that many older adults do not engage with technology because they cannot see the benefit, i.e., they have low value expectations from technology use. But in the face of a

sudden move to contactless exchanges *via* apps and QR codes, the value proposition in owning a smartphone, and having the skills to use it, changes.

Some people being turned away from a restaurant or finding that they cannot access a menu, or pay for their food is not a "legitimate" social disadvantage. It is not an acceptable new "'societal norm" that older adults should be turned away simply because of the devices they own or their levels of digital literacy. RDT scholars would not expect such unfairly disadvantaged individuals to simply upskill themselves but would ask what steps society could take to address the problem. Helsper (2017) asks whether there are *mesocommunity processes* that could be put in place, leading to structural and sustainable changes in digital inequalities, stating: *"we do not yet know in which ways outrage at how the unequal distribution of digital resources disadvantages a particular community could lead to collective calls for action." (p 234).*

It is not yet clear what societal or mesocommunity processes have been put in place as a result of the inequalities associated with the COVID-19 pandemic. There has indeed been "outrage" at some of the health inequalities that have come to light as the pandemic effectively exposed 'fault lines' within existing systems (Kawachi, 2020). The digital inequalities we have described in this paper are insignificant by comparison, but they are interesting nonetheless, not least because of the speed with which the landscape changed and digital fault lines became exposed. At the time of writing, this landscape has changed once again. QR codes and restaurant apps have faded away a little, and there has been a return to at least a hybrid system where one can once again order or speak directly to a waiter or bartender. In future work, it would be interesting to note the extent to which changes in skill levels acquired during and immediately post-pandemic would be sustained, or indeed whether attitudes toward digital skill acquisition changed for good in some segments of the older adult population. For example, was there any significant change in relation to "self-ageism" and the belief that one is too old to learn? Did some people become more aware of the technological skills of their immediate peers and start to consider the ways in which their own mindset might put them at a disadvantage? Or were other contextual factors at play that meant that, for some, they could once again eschew technology as being simply unnecessary given their own lifestyle choices. Such questions could guide a more nuanced understanding of the actions society might take in relation to the somewhat pernicious digital divide.

7. Limitations and considerations

A possible limitation of this study is the potential for self-selection in our sample, i.e., that our participants are those who have enough digital literacy to engage with online surveying companies such as Prolific, and as such are likely to be more digitally proficient than their peers. Although we could consider this a weakness, it is highly likely that negative connotations of becoming digitally excluded by the rollout of new digital interactions are likely to be exacerbated even further in those with limited access to technology, or the requisite digital skillsets to navigate such interactions. As such, the implications for older adults outlined here are likely to represent only the "tip of the iceberg." Future research is required to understand the extent to which such exclusion impacts the lives of those in such positions.

Our sampling was intentionally broad within this study, designed to access a wide range of experiences from our participants. We placed no boundary on participant nationality or locality but found interesting similarities in the experiences we gathered in spite of this. Given the qualitative nature of this study, such similarities are outside of the scope of this paper, but the research community would likely benefit from understanding how technological solutions to the COVID-19 pandemic varied across nations, especially when considering the possible implications of wealth and health inequalities.

To further access a wide range of experiences, we also sampled broadly in terms of age, using a 50+ age criteria. As mentioned earlier in this paper, a large array of criteria are used across the extant literature base when working with older adults. It is however important to highlight that technology use and acceptability is likely to range within the older adult population. The older adult population is arguably the most diverse group of users, ranging from early adopters (and early developers) to those who have, and always will be, reluctant users of technology. Acknowledging this variability through inclusive design (Clarkson and Coleman, 2015) is essential to ongoing efforts to include older adult users in the technology landscape, especially those who are keen to do so but who are underserved by policymakers and developers who assume a base level of knowledge and access which may not be as prevalent across all user groups.

It is also important to acknowledge that many of the issues highlighted in this paper are not only experienced by older adults. Digital inequalities span across a number of (particularly marginalized) groups and are exacerbated by intersectionality (Zheng and Walsham, 2021). As such, many of the issues we report here are not only experienced by older adults, but are driven by the systemic inequalities we refer to above. Identifying and increasing the transparency of the issues underpinning digital inequality is therefore one possible avenue to help counteract the self-directed ageist stereotypes experienced by older adults.

8. Conclusion

In this paper, we have described new forms of digital exclusion, particularly in the hospitality industry, that adversely affected older adults during the post-lockdown period. We have described how both extrinsic (access to devices and services) and intrinsic (possession of relevant skills and knowledge) factors could lead to older adult exclusion and generate feelings of anger, embarrassment, and shame. We interpreted our findings in terms

of relational deprivation theory (wherein inequalities that were once acceptable are now deemed unjust) and also in terms of the limiting effects of self-agism. We also found evidence of digital mobility: Some people, in the face of sudden and seemingly unjust digital change, swiftly acquired relevant skills, provided they had ready access to "warm experts," and could acquire the necessary self-belief.

Data availability statement

The datasets presented in this article are not readily available because due to the identifiable qualitative nature of the data, raw data will not be made available. Requests to access the datasets should be directed to benjamin.a.morrison@northumbria.ac.uk.

Ethics statement

The studies involving human participants were reviewed and approved by Northumbria University School of Psychology Ethics Committee. The patients/participants provided their informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1100521/full#supplementary-material

SUPPLEMENTARY FIGURE S1
Question text provided to participants as part of the online qualitative survey.

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Interacting with chatbots later in life: A technology acceptance perspective in COVID-19 pandemic situation

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Introduction: Within the technological development path, chatbots are considered an important tool for economic and social entities to become more efficient and to develop customer-centric experiences that mimic human behavior. Although artificial intelligence is increasingly used, there is a lack of empirical studies that aim to understand consumers' experience with chatbots. Moreover, in a context characterized by constant population aging and an increased life-expectancy, the way aging adults perceive technology becomes of great interest. However, based on the digital divide (unequal access to technology, knowledge, and resources), and since young adults (aged between 18 and 34 years old) are considered to have greater affinity for technology, most of the research is dedicated to their perception. The present paper investigates the way chatbots are perceived by middle-aged and aging adults in Romania.

Methods: An online opinion survey has been conducted. The age-range of the subjects is 40–78 years old, a convenience sampling technique being used (N = 235). The timeframe of the study is May–June 2021. Thus, the COVID-19 pandemic is the core context of the research. A covariance-based structural equation modelling (CB-SEM) has been used to test the theoretical assumptions as it is a procedure used for complex conceptual models and theory testing.

Results: The results show that while perceived ease of use is explained by the effort, the competence, and the perceive external control in interacting with chatbots, perceived usefulness is supported by the perceived ease of use and subjective norms. Furthermore, individuals are likely to further use chatbots (behavioral intention) if they consider this interaction useful and if the others' opinion is in favor of using it. Gender and age seem to have no effect on behavioral intention. As studies on chatbots and aging adults are few and are mainly investigating reactions in the healthcare domain, this research is one of the first attempts to better understand the way chatbots in a not domain-specific context are perceived later in life. Likewise, judging from a business perspective, the results can help economic and social organizations to improve and adapt AI-based interaction for the aging customers.

KEYWORDS

chatbots, technology acceptance model, middle-aged and aging adults, perceived ease of use, perceived usefulness, behavioral intention

Introduction

The COVID-19 pandemic situation has transformed technology into a focal point. From work-from-home situations to remote education and remote communication, the pandemic forced individuals, regardless of their cognitive, affective, and behavioral profile, to adopt all types of technologies that have been rapidly developed and adapted. Although the technological solutions existed before the crisis, the rhythm of implementing them increased exponentially. Likewise, since the beginning of the pandemic, there is an increasing pressure on the healthcare system, especially dedicated to aging population, and, thus, digital solutions are intensively searched for (Valtolina and Marchionna, 2021). Artificial Intelligence (AI) is considered as one of the most important priorities when it comes to investment (Sheth et al., 2019). In this respect, chatbots' market is expected to growth to USD 24.98 billion with a 24.2% Compound Annual Growth Rate (CAGR) by 2030 (Market Research Report, 2022).

Within the technological development path, chatbots are an important tool for companies to become more efficient (Canhoto and Clear, 2020), to create a more personalized digital experience, and to develop "customer-centric" experiences that mimic human behavior (Toader et al., 2020). Moreover, chatbots are increasingly used for healthcare purposes (Tamamizu et al., 2017; Mesbah and Pumplun, 2020; Zhang and Zheng, 2021), as they support the independence of aging adults, reduce the burden on caregivers, have the capacity to make people talk more honestly (Miura et al., 2022), and are effective in increasing the conversation time (Ryu et al., 2020).

Being built based on AI's features, chatbots are considered intelligent entities that understand verbal, written, or multimodal communication, that are programmed to semantically respond, using natural conversational language, and that can learn from past experiences to improve themselves (Sheth et al., 2019; Toader et al., 2020). Although chatbots are already usually found in the online retail domain, their presence is increasingly acknowledged in the healthcare field (Valtolina and Marchionna, 2021). Thus, the most common chatbot applications are in domains as healthcare, e-commerce / customer services, education, financial and banking services (Bächle et al., 2018; Toader et al., 2020; Alt et al., 2021), or tourism (Melián-González et al., 2021).

The changes brought by the technological development have led to fundamental changes in the interaction between economic or social entities and consumers (Toader et al., 2020). Thus, studying chatbots' impact on individuals' perception becomes of great importance. Although AI technologies are increasingly used in interactions with customers, from pre-purchase to service support, there is a lack of empirical studies that aim to understand consumers' experience with AI in general, and with chatbots in particular (Ameen et al., 2020; Nichifor et al., 2021). Likewise, most of the studies are in the computer science domain and are technically testing chatbots' prototypes.

Moreover, in social sciences, chatbot studies on the Romanian context are limited. The existing ones are mainly focused on the relationship between chatbots' error and gender, social presence, perceived competence, anthropomorphic design and trust in the digital marketing domain (Toader et al., 2020), on the acceptance of digital banking services (Alt et al., 2021; Schipor and Duhnea, 2021), on electronic commerce (Nichifor et al., 2021), or on marketing communication (Popescu, 2020). Yet, a not domain-specific approach that considers regular chatbots used in all types of daily online interactions might add value to the already existing research.

Simultaneously with the technological development, one of the most significant social transformations of the twenty-first century is the population aging. Globally, persons aged 65 or above have outnumbered children under 5 years old and it is estimated that by 2050, there will be around 2.1 billion aging adults worldwide (United Nations (UN), 2022). In the case of Romania, the average age is already 42 years old, and the most numerous age-range is 50–54 years old (Dan, 2022). Furthermore, it is estimated that by 2050, 60% of the population will be over 65 years old (Coman, 2021) and, thus, loneliness and isolation are predicted to deepen (Da Paixão Pinto et al., 2021). This reality is believed to increase both the economic and social pressure, as there is a rise in public health expenditure (Chen and Schulz, 2016; Fang and Chang, 2016; Segercrantz and Forss, 2019), a permanent need for improved healthcare assistance and assistive living, and a scarce of providers (Hofmann, 2013; Bassi et al., 2021). Low income and high workload generate a shortage of caregivers (Yang et al., 2015).

Thus, technology is believed to solve the gap between the needs of aging population and the potential of the society to overcome them, to prevent isolation, to communicate, to interact, and to monitor (Niehaves and Plattfaut, 2014; Petrie et al., 2014; Huh and Seo, 2015). In this context, an improved quality of life means smart medical care, virtual companion, mental health monitoring, open-ended conversations, emotional and knowledge-based responses, reminders, notifications, or financial duties (Bassi et al., 2021).

Baby boomers (people between 57 and 75 years old) and generation X (people between 42 and 56 years old) are considered "*digital illiterates*" (Vasilateanu and Turcus, 2019). As this dichotomy is too sharp, Lenhart and Horrigan (2003) consider that a digital spectrum approach is more correct. Relying on the fact that each generation has its technology laggards, on the fact that aging adults are not a homogenous cohort in terms of technology use, age should be correlated with other variables, as education or frequency of use of a certain application or device (Loos, 2012). Based on the digital divide (unequal access to technology, knowledge, and resources; DiMaggio et al., 2001), since young people are considered to have a greater affinity for technology, most of the research is dedicated to the perception of Generation Z and Millennials (people between 18 and 34 years old; Nichifor et al., 2021; Schipor and Duhnea, 2021). Thus, unfairly, the views of middle-aged individuals and aging adults on technology are receiving less attention (Nikou, 2015). Digital divide should rather be understood as relative rather than absolute inequalities that can be reduced (Van Dijk and Hacker, 2003). Furthermore, as

the literature highlights a varied range of technologies that can improve aging adults' lives, their perception on technology is rarely assessed (Pal et al., 2018). Since the technology developers are usually young people, a gap between what is invented and what is needed appears (Lee and Coughlin, 2014). Although chatbots are designed to be able to identify health problems based on the exposed symptoms, such applications are mainly restricted to young generations (Mesbah and Pumplun, 2020). Thus, the aging adults' user experience should be better understood for more suitable innovations.

To the best of our knowledge, there is a lack of studies that focus on the general use of chatbots by aging population, without particularly emphasizing the healthcare or assistive domains. One of the newest paper in this respect is a systematic literature review written by Da Paixão Pinto et al. (2021) in which authors are interested in the engagement strategies of the chatbots, in their computational environments, in the input data format accepted, in the different types of personalization offered, and in the evaluation techniques for conversational agents. Being based on a systematic analysis of 53 papers, the main results of the study emphasize that personalization, context adaptation, a speech type input, and an intuitive system are at the core of an increased engagement and interaction with chatbots (Da Paixão Pinto et al., 2021). However, based on the existing findings,, further empirical investigation is needed.

Based on the existing literature, we find that chatbots are mainly studied from a computer science perspective, on a young audience, or with a strong focus on healthcare domain. Thus, the present paper aims to empirically deepen the social-science knowledge on chatbots both by understanding the middle-aged and aging adults' perceptions on chatbots in Romania and by analyzing possible determinants of behavioral intention on using chatbots in a not domain-specific perspective. An online opinion survey has been conducted on a convenience sample ($N = 235$), aged between 40 and 78 years old ($M = 51.13$, $SD = 5.954$). Although aging adults, or elderly, are persons aged 60 years old and above (United Nations (UN), 2017), due to the limitations given by the convenience sampling procedure, this study extends the analyzed age range and aims to comparatively investigate the differences, if any, between middle-aged adults and aging ones. The survey has been applied in the COVID-19 pandemic situation, between May and June 2021. By relying on Technology Acceptance Model (Davis, 1989) and on its extended version (Venkatesh and Bala, 2008), the respondents are mainly inquired on the general perceived ease of use, perceived usefulness, enjoyment, competence, effort, pressure, satisfaction, perception of external control, subjective norms, and behavioral intention, all related to the use of chatbots.

Based on Digital Economy and Society Index (2022) report, Romania is ranked as the last European Union (EU) country on digital skills and with a poor performance regarding the integration of digital technologies and digital public services. Furthermore, among developing countries, Romania is considered to be a case in which aging adults are the latest technology adopters (Ivan and Cutler, 2021). This situation has been deepened by the COVID-19 pandemic (Motorga, 2022). Considering this poor digital literacy context, Romania becomes a significant case-study on which technological development and adoption is urgently needed.

The implications of the paper are at least threefold. First, the present study aims to enrich the existing literature with a technology acceptance overview on the way chatbots are perceived, regardless of the domain. Interestingly, in comparison with the results of other studies testing technology acceptance models, the present data show that some variables (e.g., enjoyment, satisfaction, etc) do not have the hypothesized effect in explaining behavioral intention in respect to chatbot interaction. Explanations might be related to the target group of the study (which is different than most of the samples used in similar context), or to their understanding and experience with chatbots. Thus, the results open new research perspectives for verifying the present model's outcomes. Second, the research fulfills the existing gap on the target group. Since most of the studied samples are composed of young people, the present approach focuses on middle-aged and aging adults. Finally, judging from a business perspective, the results can help economic and social organizations to improve and adapt AI-based interaction for the aging customers.

Chatbots

Chatbots are also known as chatterbots (Miliani et al., 2021), smart bots or interactive agents (Adamopoulou and Moussiades, 2020), virtual assistants or conversational agents (Sheth et al., 2019). They are chatty software machines that, based on artificial intelligence features and natural language processing, interact with users using written text or spoken language (Bächle et al., 2018) and relying on image, video, and audio processing (Bala et al., 2017). Put it differently, a chatbot is a computer program designed to interact through a natural dialog with users and to create the sensation of communicating with a human being (Hussain et al., 2019). Conversational agents are either on-screen or as voice assistants (Gunathilaka et al., 2020).

When Alan Turing proposed the Turing Test [in which users are tested if they are capable to differentiate between an interaction with a human being or a machine (Chen et al., 2020)], starting from the question "*if machines can think?*," the idea of chatbots started to spread (Adamopoulou and Moussiades, 2020). Chatbot ELIZA, a simulation of a person-centric psychotherapist, is the first chatbot attempt. It was developed in 1966 by Josepth Weizenbaum and it used word and pattern matching techniques to conduct simple conversation (Bächle et al., 2018; Nichifor et al., 2021). ELIZA program used to search for keywords within the user's input and transform the sentence into a script (Hussain et al., 2019). In the 80's, chatbots have been mainly developed for the gaming industry and they have been used for testing if individuals can recognize them as being machines or humans (Bächle et al., 2018). Although early chatbots lacked the ability to maintain a conversation going (Hussain et al., 2019), as the conversational agents use more and more natural language processing, they pass the Turing Test (Justo et al., 2021). In 1995, ALICE chatbot, a highly awarded software, has been developed

and has been considered the "most human computer" until that moment (Adamopoulou and Moussiades, 2020). After the development of chatbots available through messenger application, like SmarterChild, in 2001, or Wechat in 2009 (Mokmin and Ibrahim, 2021), the creation of virtual personal assistance has begun (e.g., Siri form Apple, Cortana from Microsoft, Alexa from Amazon, Google Assistant, or IBM Watson; Liu et al., 2018; Adamopoulou and Moussiades, 2020; Gunathilaka et al., 2020).

Chatbots can be either task-oriented or non-task-oriented (Hussain et al., 2019). Task-oriented chatbots are created for very specific tasks and domain-based conversations. Examples in this respect are booking accommodation, booking a flight, placing an order in online shopping, accessing specific information, etc (Hussain et al., 2019). The drawback of a task-oriented system is that it cannot exceed the programmed topic scope (Su et al., 2017). Non-task-oriented chatbots is rather keen on conversating for entertainment purpose in all kinds of domains and in an unstructured manner (Hussain et al., 2019; Justo et al., 2021).

As chatbots are imitating human-to-human interaction, they are often perceived as anthropomorphic (Seeger et al., 2018). Moreover, they are one of the most used examples of intelligent human-computer interaction (Adamopoulou and Moussiades, 2020). The literature talks about the capability of chatbots to expand beyond repetitive tasks (mechanically intelligent AI) and conduct thinking tasks (analytical intelligent AI), creative tasks (intuitive intelligent AI), and feeling tasks (empathetic intelligent AI). While mechanic chatbots provide predefined responses, the analytical chatbots analyze the given problems, intuitive chatbots contextually understand complains, and emphatic chatbots recognize and understand users' emotions (Youn and Jin, 2021).

While the technological development's aim is that of creating realistic human-like chatbots, in comparison with an employee, a chatbot is constantly updating, has unlimited memory, acts instantly, and it is available all the time (Lo Presti et al., 2021). The most important features of chatbots are their capability of being self-contained, always active, and able to track users' interest, preferences, and socio-demographics (Tascini, 2019). Chatbots can be used for customer services, allowing companies to target consumers in a very personalized way (Alt et al., 2021) and expanding satisfaction and engagement (Maniou and Veglis, 2020). They are considered a technological trend for the companies as they can speed up and facilitate customer service process through providing online information or placing orders in real time (Ashfaq et al., 2020; Nichifor et al., 2021). Chatbots allow users to interact online with different organizations, anytime and from any place, and offer quick and meaningful responses (Alt et al., 2021). A useful chatbot is responsible to provide assistance without interfering, and developing a sense of trust (Zamora, 2017).

The functionality of chatbots is either for entertainment or utilitarian (Zamora, 2017). Conversational systems are increasingly used and are useful both at home and for leisure (e.g., Alexa, Siri), or in our professional life (e.g., Siri, Cortana) for managing the schedule or for educational purposes (Justo et al., 2021; Valtolina and Hu, 2021). Chatbots are mainly used for obtaining information, for interacting needs and out of curiosity (Gunathilaka et al., 2020).

Studies have revealed that chatbots perform better is they are specifically created for a certain domain or group (De Arriba-Pérez et al., 2021). Chatbots can be used in domains such as e-commerce, business, marketing, communication, education, news, health, food, design, finance, entertainment, travel, or utilities, but not limited to them (Liu et al., 2018; Adamopoulou and Moussiades, 2020). Technology is undoubtedly perceived as being the solution for improving healthcare. Scholars that develop chatbots talk about the need of designing empathetic virtual companions to alleviate isolation and loneliness (Da Paixão Pinto et al., 2021) and to fulfill the emotional needs of the aging adults and to increase likeability and trustworthiness towards machines (Yang et al., 2015). As the main motivation to use chatbot is productivity, together with entertainment and socialization, chatbots should be equally built as a tool, a toy, and a friend (Brandtzaeg and Følstad, 2017).

The literature also emphasizes on the downsides of chatbots use, especially on the reluctance on interacting with an impersonal machine instead of a human being (Nichifor et al., 2021). Although chatbots are increasingly resembling humans, this can be perceived as a disadvantage since privacy and security issues are associated with human hackers (Michiels, 2017). At the same time, while programmed with natural language processing, the interaction with chatbots is not intuitive enough and might imply errors. Thus, the lack of human feelings and emotions echoes on the lack of engagement and personality (Knol, 2019). For instance, in a shopping context, most of the users feel uncomfortable receiving personalized feedback from chatbots and consider them as being immature technology (Rese et al., 2020; Smutny and Schreiberova, 2020). Hildebrand and Bergner (2019) highlight the possibility that a chatbot service interaction provided to an already disappointed consumer might have a deep negative effect on both the service value and the brand or the organization. Furthermore, while users might have limited knowledge on chatbots and might consider them as inferior and unworthy entities to communicated with, the feeling of discomfort can lead to the refusal of interaction (Ivanov and Webster, 2017). When it comes to elderly, chatbots are associated with privacy issues, with loss of autonomy, with technical fears, or with lack of usefulness that can increase their resistance and avoidance (Da Paixão Pinto et al., 2021). Thus, although useful for organizations, there are many variables that can deter a good communication flow between chatbots and users. While, on one hand, there are the features of the chatbots (e.g., the way they are designed, their cognitive capabilities, etc), on the other hand there are the variables affecting the perception on them (e.g., knowledge on and experience with technology, the need for a human-natural conversation, or usefulness).

Technology acceptance, chatbots and aging

Renaud and Van Biljon (2008) talk about three main reasons for technology adoption. First, there is the support given for certain activities, as information, communication, administrative,

entertainment, or health monitoring. Second, there is the convenience reason, referring to reducing physical and mental endeavor. Finally, there are the technology features, namely the design of the device, specific actions, and options. The attitude toward technology, measured on the strength of how much an individual likes or dislikes it, is also believed to be a key factor in accepting and adopting a particular technology (Edison and Geissler, 2003).

The most referred to theory on technology acceptance is Technology Acceptance Model (TAM; Davis, 1989). Aiming to predict behavior, this theory is inspired from the Theory of Reasoned Action (TRA; Fishbein and Ajzen, 1975) and the Theory of Planned Behavior (TPB; Ajzen, 1985). TAM emphasizes that perceived ease of use and the perceived usefulness, together with other external variables, can predict the attitude towards using a certain technology, the intentional behavior, and, finally, the actual behavior (Davis, 1989; Renaud and Van Biljon, 2008; Minge et al., 2014; Alt et al., 2021). While perceived ease of use is defined as the degree to which using a particular device or system is free from effort, perceived usefulness is the degree to which using a certain device enhances one's performance (Davis, 1989; Wang and Sun, 2016). Although perceived usefulness is considered as being a stronger predictor for the intentional behavior, perceived ease of use is a key variable for the initial acceptance (Lin et al., 2007; Renaud and Ramsay, 2007). Behavioral intention, as a strong predictor of the actual behavior, is defined as the strength of one's aim to execute a specific behavior (Fishbein and Ajzen, 1975). Furthermore, as a certain device or application is easy to use, it is predicted that this perception is likely to influence the perceived usefulness (Venkatesh and Bala, 2008).

One of the most complex models that aims to explain technology acceptance is TAM3 (Venkatesh and Bala, 2008). Being developed in a managerial context and on a longitudinal perspective, the new model builds on the anchoring and adjustment framing of human decision and adds new variables and connections to the previous models. In the context of decision making, anchoring refers to relying on the available initial information, information that can further influence the decision but that will decline over time when adjustment knowledge will be accessible (Cohen and Reed, 2006; Qiu et al., 2016). Thus, the anchor variables, as device self-efficacy [perceived abilities to perform a specific task using a certain technology (Compeau and Higgins, 1995)], perception of external control [perceived control and resources on using a certain technology (Venkatesh et al., 2003)], and device anxiety (fear on using a certain technology) are considered as influencing the perceived ease of use (Venkatesh and Bala, 2008).

The same relationship is developed when it comes to adjustment variables as perceived enjoyment on the use of a certain technology and objective usability (the effort required to interact with a certain technology; Venkatesh, 2000). The literature stresses on some universal incentives that can motivate individuals and that can predict intention to use a certain technology. While on one hand, there are the utilitarian rewards, as achievements, or ease of use, on the other hand, there are the hedonic rewards, as enjoyment and entertainment (Kim et al., 2018; Van Roy et al., 2018). Relying on Uses and gratification theory (Blumler and Katz, 1974), users tend to accept a device or an application if they feel rewarded (in terms of knowledge, relaxation, escapism, or social interaction) by using it (Kim et al., 2018; Wang et al., 2018). Likewise, an enjoyable experience with the technology is becoming increasingly infused into acceptance decision (Deng, 2017; Tsoy, 2017). Strongly linked with enjoyment, satisfaction is also considered as an import variable that can positively influence the perceived ease of use of a certain device or application (Zamora, 2017). At the same time, subjective norms, defined as the degree to which users consider that people in their trust circle should use a certain technology (Venkatesh and Davis, 2000), are believed to influence the perceived usefulness and behavioral intention.

Especially affected by the pandemic, but even beyond it, aging adults' lives are usually characterized by loneliness and isolation. To avoid mental issues, like depression and anxiety, they need to be engaged into the daily routine, to be stimulated and entertained (Valtolina and Hu, 2021). Social interaction is considered a basic need for aging population in which solitude is one of the biggest issues (De Arriba-Pérez et al., 2021). Like in a vicious circle, social isolation, rejection, or loneliness seems to have a paramount negative effect on the general and mental health of an individual. Thus, assistive technology, by its social interaction capabilities and engagement, can help in preventing illnesses (Gunathilaka et al., 2020) and offers a more comfortable and cost-effective medical care (Mesbah and Pumplun, 2020). However, although technology can solve this problem, aging adults are resistant to change (Vichitvanichphong et al., 2017) and the digital divide is a barrier (De Arriba-Pérez et al., 2021). Considering that many devices and applications are created without considering users' perception and are designed by young people, many aging adults are reluctant to products they do not understand (Lee and Coughlin, 2014; Peliz̈aus-Hoffmeister, 2016). In this respect, the experience with a certain technology is a key moderator variable for perceived ease of use and perceived usefulness relationship, for the technology anxiety and perceived ease of use, and for the perceived ease of use and behavioral intention (Venkatesh and Bala, 2008). In the present context, the previous use of chatbots (Luo and Remus, 2014), the previous knowledge on them (Cui and Wu, 2019), the initial attitude on them (Hall et al., 2017), and how it is liked might be important variables.

Some studies, by offering a generalized perspective, claim that aging adults perceive themselves as being too old to learn how to use technology (Feist et al., 2010). They are having less experience with devices, have fewer specific skills (Damant and Knapp, 2015), and the feelings of helplessness are being reinforced by failed previous experiences (Minge et al., 2014). In the case of aging population, some of the main largely accepted motivations to learn to use technology are social integration, usefulness, and security (Chou and Liu, 2016; Wang et al., 2018). Thus, being

helpful and fulfilling needs and expectations become paramount variables (Gatti et al., 2017).

When it comes to chatbots, most of the studies are relying on young samples. Moreover, the literature review reveals that almost all papers on the use of chatbots for aging population are related to the healthcare or assistive domain. Almost all of them are written from a technical point of view by computer science specialists. Although AI developments in assistive technology are advanced, there is still work to be done for achieving a proper chatbot for end aging users (De Arriba-Pérez et al., 2021). Thus, the existing studies refer to presenting, designing, and testing prototypes of conversational agents with meaningful, empathetic emotional, and friendship capabilities (Yang et al., 2015; Bassi et al., 2021), with personalized entertainment content access (De Arriba-Pérez et al., 2021), with workplace environment facilities (Bächle et al., 2018), with capabilities to promote healthy habits through a coaching model (Justo et al., 2021), with public administration abilities (Miliani et al., 2021), with virtual caregiving attributions (Su et al., 2017; Ryu et al., 2020; Valtolina and Hu, 2021; Miura et al., 2022).

In a systematic literature review on general use of chatbots by aging adults, Da Paixão Pinto et al. (2021) have found that, considering the innovations in natural language processing, speech is the most used and preferred input format for aging adults to interact with chatbots. They also emphasize that assistive conversational agents still face acceptance problems, low involvement, and low user satisfaction mainly due to the loss of autonomy, privacy, and technical errors (Da Paixão Pinto et al., 2021).

Based on a set of interviews on assistive living with long term patients in Sri Lanka, Gunathilaka et al. (2020) have found that, due to poor sight, voice-based conversational agents can be helpful for long-term patient care if they are specialized for specific requirements, in accordance with individuals' needs. However, although virtual agents can help aging adults to be more independent and better enjoy the lonely moments, the devices cannot substitute a human caregiver especially from an emotional point of view (Gunathilaka et al., 2020).

A comprehensive study on aging adults' acceptance of health chatbots is using the extended Unified Theory of Acceptance and Use of Technology (UTAUT2) model (Venkatesh et al., 2012) to qualitatively test the factors that contribute to the adoption intention (Mesbah and Pumplun, 2020). Beside the interviews, the respondents have tested a health chatbot for a better understanding of the technology. The results show that behavioral intention to use a health chatbot depends not only on the performance expectancy, effort, social influence, facilitating conditions, as the initial model states, but also on variables as patience, resistance to change, need for emotional support, technology self-efficacy and anxiety, privacy risk expectancy, or trust in the technology and in the recommendation of a chatbot (Amato et al., 2017; Mesbah and Pumplun, 2020). As trust is especially considered an important factor in technology acceptance, it is predicted to positively impact the intention to use a certain technology, the perceived ease of use and the perceived usefulness when it comes to e-commerce and e-services (Gefen and Straub, 2003; Pavlou, 2003; Lankton et al., 2015; Cardona et al., 2021).

When it comes to gender, technology acceptance is debatable. While some studies consider that there are no significant relationships between gender and computer attitude (Nash and Moroz, 1997), men tend to score higher than women in affinity for technology (Edison and Geissler, 2003). Gender is usually considered as a moderator variable within the technology acceptance models (Bagana et al., 2021). Although the difference between men and women is narrow, men are believed to experience a lower level of technology anxiety (Damant and Knapp, 2015) and thus a higher behavioral intention.

Based on the above-described literature, the hypotheses of the paper are listed below:

> *H1*: Perceived ease of use of chatbots is positively impacted by enjoyment (H1a), satisfaction (H1b), effort (H1c), competence (H1d), pressure (H1e), and perception of external control (H1f).
>
> *H2*: Perceived usefulness of a chatbot is positively impacted by the perceived ease of use (H2a) and the subjective norms (H2b).
>
> *H3*: Behavioral intention to use a chatbot in the future is positively impacted by the perceived usefulness (H3a), perceived ease of use (H3b), subjective norms (H3c), and previous experience with a chatbot [knowledge on chatbots (H3d), hearing about chatbots (H3e), use of chatbots (H3f), and like chatbots (H3g)].
>
> *H4*: Men in comparison with women (H4a), and middle-aged in comparison with aging adults (H4b) are more likely to report a higher level of behavioral intention to use chatbots in the future.

The schematic version of the structural model is presented in the Figure 1.

Methodology

Procedure

To assess the above-mentioned relationships, an online opinion survey has been conducted. The questionnaire has been designed in Google Forms and it has been self-administrated during COVID-19 pandemic, namely between May and June 2021. Considering that the sample is formed of people over 40 years old and to avoid discrepancies due to communication difficulties (Cardona et al., 2021), the questionnaire has been developed in Romanian language. For a clear understanding of the research scope, the questionnaire has an introduction part in

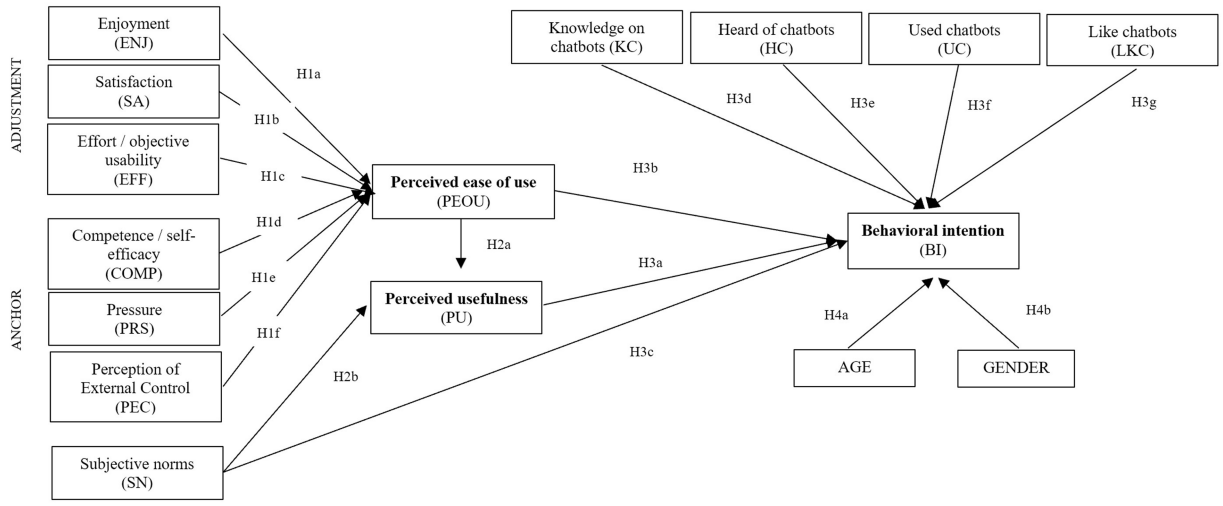

FIGURE 1
The structural model.

which the aim of the survey is presented together with information about the anonymity and confidentiality of the data. Moreover, for a more accurate understanding of a chatbot interaction, a small example has been given at the beginning of the survey (Figure 2). Andrei is the chosen name for the chatbot, as it is one of the most familiar names in Romania.

The questionnaire is composed of three main sections. The first section evaluates the previous experience with chatbots (if the users have heard of chatbots, of they use them, if they have knowledge on them, and if they like interacting with them). At the same time, the situations in which chatbots have been used and their perceived benefits are inquired. The second section highlights the main variables of technology acceptance models: perceived ease of use, perceived usefulness, enjoyment, satisfaction, effort, competence, pressure, perception of external control, subjective norms, and behavioral intention. The last section is dedicated to the socio-demographical variables.

A covariance-based structural equation modelling (CB-SEM) has been used to test the theoretical assumptions as it is a procedure used for complex conceptual models (Nitzl, 2016; Hair J. et al., 2019) and theory testing (Hair J. et al., 2019; Hair J. F. et al., 2019). The data has been analyzed using IBM SPSS and Amos 26 version.

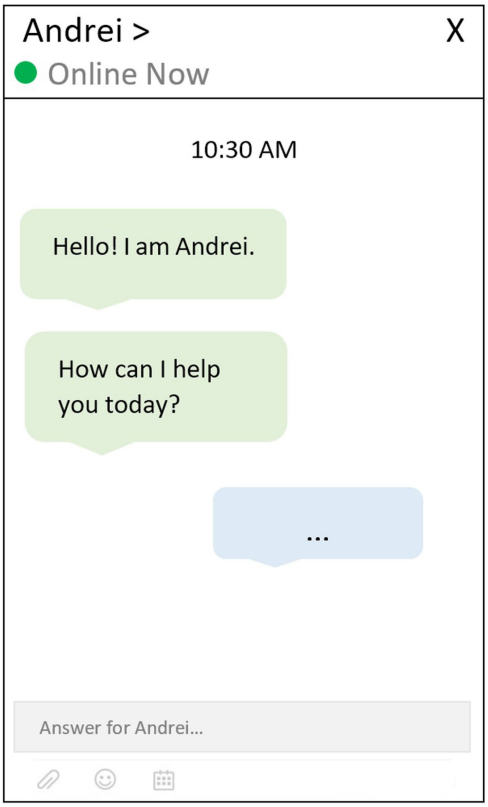

FIGURE 2
An example of chatbot interaction given within the survey.

Sample

The analyzed sample ($N = 235$) is formed of middle-aged (57.4%) and aging adults (41.6%), out of which 59.1% are females. The average age of the respondents is $M = 51.13$, $SD = 5.954$. Age has been measured as a continuous variable ("*Please state your age in full years*"). While middle-aged people are considered adults between 36 and 55 years old (Petry, 2002), aging adults are people over 50 years old (Mitzner et al., 2008; Renaud and Van Biljon, 2008). In the case of the present paper, middle-aged respondents are considered the ones between 40 and 50, and the aging ones are over 50. The age range of the present sample is 40–78 and these age limits are due to the sample selection process. The sample has

been selected using the convenience sampling technique (Parker et al., 2019). Undergraduate communication students, on a voluntary basis and coordinated by the authors, sent the online questionnaires to their aging relatives. The questionnaires have been filled in between May and June 2021. Most of the respondents have an urban residence, have university studies, and have an income higher than 500 euros per month. Thus, there is the need to emphasize, from the very beginning, an over-representation of some demographic groups in the sample.

The table below (Table 1) summarizes the main demographic variables of the respondents.

TABLE 1 Demographics of the respondents.

Respondents' characteristics	Frequency (*N*=235)	Percentage (%)
AGE		
40–50	135	57.40
51–78	100	42.60
GENDER		
Females	139	59.10
Males	96	40.90
RESIDENCE		
Urban	193	82.10
Rural	42	17.90
EDUCATION		
Primary school	1	0.40
Lower secondary education (8 classes)	5	2.10
Professional school	38	16.20
High school	0	0
Post-secondary school	53	22.60
University studies	138	58.70
INCOME		
Less than 300 euros	21	8.90
301–500 euros	54	23
501–700 euros	47	20
701–900 euros	53	22.6
More than 900 euros	60	25.5

Measurements

The measurements have been adapted from the previous validated methodologies and developed based on the literature.

The previous experience with chatbots is measured by using the following variables. The respondents have been asked if they have heard about chatbots (HC) and if they have ever used them (UC; Lou and Remus, 2014) on scale from 1 to 7, where 1 = *never* and 7 = *very frequently*. Likewise, on a 7-point scale (1 = *nothing at all*, 7 = *a lot*), they have been inquired on their knowledge about chatbots (KC; Cui and Wu, 2019). The general attitude towards chatbots has been measured by using a simple question on liking this type of interaction (LKC; Edison and Geissler, 2003), on a 7-point scale, where 1 = *not at all* and 7 = *very much*.

The perceived ease of use (PEOU) scale, with seven items, is measured on 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Van der Heijden et al., 2003; Venkatesh and Bala, 2008; Luo and Remus, 2014).

The perceive usefulness (PU) of interacting with chatbots uses nine items and it is measured on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Venkatesh and Bala, 2008; Luo and Remus, 2014; O'Brien et al., 2018).

The enjoyment (ENJ) produced by interacting with a chatbot is measured through eight items, on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Ryan, 1982; Ryan et al., 1983, 1990, 1991; Plant and Ryan, 1985; McAuley et al., 1987; Deci et al., 1994; Venkatesh and Bala, 2008).

The satisfaction (SA) with the interaction, or the output quality is measured through six items on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Lou and Remus, 2014; Sherry et al., 2006; Venkatesh and Bala, 2008).

The effort (EFF) involved in chatbot interaction, or the objective usability, is measured using two items, on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Ryan, 1982; Ryan et al., 1983, 1990, 1991; Plant and Ryan, 1985; McAuley et al., 1987; Deci et al., 1994; Venkatesh and Bala, 2008).

The perceived competence (COMP) of using a chatbot, or technology self-efficacy, is measured based on four items, on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Ryan, 1982; Ryan et al., 1983, 1991; Plant and Ryan, 1985; McAuley et al., 1987; Ryan et al., 1990; Deci et al., 1994; Venkatesh and Bala, 2008).

The pressure (PRS) or anxiety generated by an interaction with a chatbot is measured by using 5 items on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Ryan, 1982; Ryan et al., 1983, 1990, 1991; Plant and Ryan, 1985; McAuley et al., 1987; Deci et al., 1994; Venkatesh and Bala, 2008).

The perception of external control (PEC), or how much control one has on interacting with chatbots, is measured through two items on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Venkatesh and Bala, 2008).

The subjective norms (SN) variable (the degree to which one perceives that people who are important to that person think he/she should use the system) is measured through two items on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Venkatesh and Bala, 2008).

The behavioral intention (BI), or the intention to use chatbots in the future, is measured through four items on a 7-point scale, where 1 = *strongly disagree* and 7 = *strongly agree* (Lou and Remus, 2014).

The table below (Table 2) summarizes all the variable and items used and provides descriptive data for each item. The internal consistency has been computed using Cronbach's α value. Overall, the results are satisfactory as all the constructs are higher than the acceptable threshold value of 0.6 (Fornell and Larcker,

TABLE 2 Measurements and items.

Variables	Items	*M* (SD)	Factor loading	Cronbach Alpha
Perceived ease of use (PEOU)	PEOU1: Learning to use this type of interaction is easy for me	4.65 (1.925)	0.847	0.964
	PEOU2: I find it easy to use this type of interaction	4.70 (1.945)	0.882	
	PEOU3: I find this interaction to be flexible	4.52 (1.938)	0.74	
	PEOU4: I find this type of interaction as being clear and understandable	4.66 (1.913)	0.893	
	PEOU5: It is easy for me to become skillful at using this type of interaction	4.72 (1.934)	0.893	
	PEOU6: This type of interaction does not require a lot of my mental effort	4.85 (1.939)	0.694	
	PEOU7: I find this type of interaction as easy to use	4.76 (2.048)	0.886	
Perceived usefulness (PU)	PU1: Using this type of interaction enables me to accomplish tasks more quickly	4.57 (1.995)	0.779	0.919
	PU2: Using this type of interaction improves my performance	4.18 (2.005)	0.869	
	PU3: Using this type of interaction increases my productivity	4.02 (2.064)	0.89	
	PU4: Using this type of interaction enhances my effectiveness	4.22 (2.057)	0.923	
	PU5: Using this type of interaction makes it easier to do my work	4.49 (2.095)	0.866	
	PU6: I find this type of interaction useful.	4.83 (1.981)	0.737	
	PU7: I felt frustrated while using this interaction	5.17 (2.025)	0.755	
	PU8: I found this interaction confusing to use	5.08 (1.910)	0.849	
	PU9: Using this interaction was taxing	5.27 (1.909)	0.756	
Enjoyment (ENJ)	ENJ1: I enjoy having this interaction very much	3.77 (1.954)	0.766	0.926
	ENJ2: This interaction is fun to do	3.28 (1.885)	0.806	
	ENJ3: I think this is a boring interaction	4.66 (1.847)	0.806	
	ENJ4: This interaction does not hold my attention at all	4.40 (1.994)	0.797	
	ENJ5: I would describe this interaction as very interesting	3.63 (1.951)	0.875	
	ENJ6: I think this interaction is quite enjoyable	3.60 (1.854)	0.919	
	ENJ7: I think this interaction is quite captivating	3.40 (1.917)	0.887	
	ENJ8: While seeing this interaction, I was thinking about how much I enjoyed it	3.10 (1.942)	0.854	
Satisfaction/output quality (SA)	SA1: This interaction is a waste of time	5.09 (2.041)	0.575	0.898
	SA2: I would like to use this type of interaction more than I already do	3.71 (2.145)	0.665	
	SA3: I am not satisfied with this type of interaction	4.92 (1.975)	0.585	
	SA4: I enjoy using this type of interaction	3.62 (2.004)	0.798	
	SA5: Using this type of interaction is personally satisfying	3.80 (1.969)	0.7	
	SA6: I feel proud that I know how to use this interaction	3.85 (2.129)	0.67	
Effort/objective usability (EFF)	EFF1: I put a lot of effort into this type of interaction	2.67 (1.853)	0.797	0.745
	EFF2: I try very hard on this type of interactions	2.93 (1.808)	0.797	

(Continued)

TABLE 2 (Continued)

Variables	Items	*M* (SD)	Factor loading	Cronbach Alpha
Competence/self-efficacy on using chatbots (COMP)	COMP1: I think I am pretty good at this interaction	4.03 (1.965)	0.895	0.954
	COMP2: I feel competent in having such an interaction	4.01 (1.915)	0.906	
	COMP3: I feel satisfied with my competence in such an interaction	3.90 (1.973)	0.842	
	COMP4: This is an interaction that I could do very well on	4.27 (2.037)	0.879	
Pressure (PRS)	PRS1: I do not feel nervous at all regarding this type of interaction	4.57(2.048)	0.246	0.795
	PRS2: I feel very tense regarding this type of interaction	5.20 (2.024)	0.783	
	PRS3: I consider this interaction very relaxing	3.39 (1.933)	0.263	
	PRS4: I am anxious regarding this interaction	5.52 (1.812)	0.78	
	PRS5: I feel pressure regarding this interaction	5.38 (1.941)	0.811	
Perception of external control (PEC)	PEC1: I have control over using a chatbot	3.76 (1.960)	0.852	0.827
	PEC2: I have the resources necessary to use a chatbot	4.14 (1.970)	0.852	
Subjective norms (SN)	SN1: People who influence my behavior think that I should use chatbots	3.56 (2.040)	0.762	0.688
	SN2: I could conduct a complete activity with the chatbot if someone would show me how	4.48 (2.062)	0.762	
Behavioral intention (BI)	BI1: I plan to use this interaction in the future	3.72 (2.012)	0.881	0.876
	BI2: I intend to continue using this type of interaction in the future	3.73 (2.032)	0.907	
	BI3: I am not likely to use this type of interaction in the future	4.66 (2.085)	0.392	
	BI4: I predict I will use this type of interaction in the future	4.21 (2.035)	0.8	

1981; Nam et al., 2018). Factor loading has been assessed for each item. Some items have been removed due to low factor loadings (<0.05; e.g., PRS1, PRS3, and BI3).

Results

From the point of view of previous experience with chatbot, more than 75% of the respondents have heard at least once about chatbots ($M = 3.64$, $SD = 1.64$) and around 70% have used this interaction at least on one occasion ($M = 2.89$, $SD = 1.710$). Table 3 presents this information in a comparative manner between women and men and between middle-aged and aging adults emphasizing on the upper part of the used scale. In this respect, age has been transformed into a dummy variable ([40–50] and [51–78] intervals). Overall, men seem to have more experience with chatbots. However, when it comes to age, the differences between middle-aged and aging adults are not that significant. Paradoxically, and probably due to social desirability, although a large majority of the respondents declare that they like chatbots ($M = 4.12$, $SD = 2.006$), only a small part of them have increased knowledge on them ($M = 3.19$, $SD = 1.598$).

As presented in Figure 3, the situations in which chatbots have been used regularly (Lou and Remus, 2014) are related to customer services and online shopping. These chatbots are similar in functionality and interaction and they are only tailored made for those domains. Furthermore, when it comes to benefits (State of Chatbot Report, 2018), as the Figure 4 shows, the respondents strongly appreciate chatbots mainly due to their availability (e.g., 24 h a day) and capabilities to solve problems (e.g., quick answers, register complains, simplify the communication process).

To better understand if there is an interaction between gender and age on the intentional behavior to use chatbots, a Two-way ANOVA analysis has been performed. The table below (Table 4) summarizes the descriptive statistics.

The test of between-subjects effect shows no significant difference in mean behavioral intention between males and female [$F(1, 231) = 0.191$, $p = 0.662$] and between middle-aged and aging adults [$F(1,231) = 0.62$, $p = 0.804$].

Table 5 presents the correlation matrix between the main variables of the study. The most powerful relationships are going to be highlighted in the following rows. While perceived ease of use is strongly, positively, and significantly correlated with perceived usefulness, competence, and pressure, the perceived usefulness is strongly linked with enjoyment, pressure, and

satisfaction. Finally, the more one likes chatbots, perceive them as being useful, enjoy them, and feel satisfaction while using them, the higher is the intention to use chatbots in the future. It is important to notice that gender is significantly correlated only with hearing on chatbots, using them, and have knowledge on them, men being more prone to that. However, the relationship is a weak one. Age is significantly and negatively correlated with perceived ease of use, perceived usefulness, effort, and pressure. Although the relationships are weak, further analyses should investigate more if middle-aged adults are perceiving chatbots as being easier to use and more useful, and if they indeed invest less effort and feel less pressure when using chatbots.

A structural model assessment has been used to test the initial hypothesized relationships. The model-fit measurements have been used to evaluate the overall goodness of fit. In this respect, the following table (Table 6) summarizes the main indicators for the model and the standard values for a good fit. The standard values for a good fit are documented from Schumacker and Lomax (2004), Schreiber et al. (2006), and Shi et al. (2019). Overall, the data show that these indicators respect the recommended values for an acceptable fit. Thus, no modifications to the model have been done.

The study assesses the impact of different independent variables related to chatbots used on perceived ease of use, perceived usefulness, and behavioral intention. The following table (Table 7) summarizes the results.

The impact of enjoyment, satisfaction, and pressure on perceived ease of use of a chatbot are not significant ($p > 0.05$). Thus, hypotheses H1a, H1b, and H1e are not supported. However, the data show that effort ($\beta = -0.138$, $t = -3.197$, $p = 0.001$), competence ($\beta = 0.569$, $t = 9.923$, $p < 0.001$), and perceived external control ($\beta = 0.124$, $t = 2.710$, $p = 0.007$) impact the perceived ease of use chatbots in a significant manner. Hence, H1c, H1d, and H1f are supported.

Perceived usefulness is positively and significantly impacted by both perceived ease of use ($\beta = 0.951$, $t = 9.541$, $p < 0.001$) and subjective norms ($\beta = 0.806$, $t = 4.434$, $p < 0.001$). Thus, H2a and H2b are supported by the data.

TABLE 3 A comparative summary on the previous experience with chatbots.

Experience with chatbots	GENDER		AGE	
	Women	Men	Middle-aged adults	Aging adults
Heard about chatbots *(Frequently and very frequently)*	28.7% ($n = 40$)	45.8% ($n = 44$)	38.5% ($n = 52$)	32% ($n = 32$)
Used chatbots *(Frequently and very frequently)*	14.4% ($n = 20$)	25% ($n = 24$)	17.8% ($n = 24$)	20% ($n = 20$)
Have knowledge on chatbots *(Much and very much)*	12.9% ($n = 18$)	30.2% ($n = 29$)	19.2% ($n = 26$)	21% ($n = 21$)
Like chatbots *(Much and very much)*	43.8% ($n = 61$)	52.2% ($n = 50$)	47.4% ($n = 64$)	47% ($n = 47$)

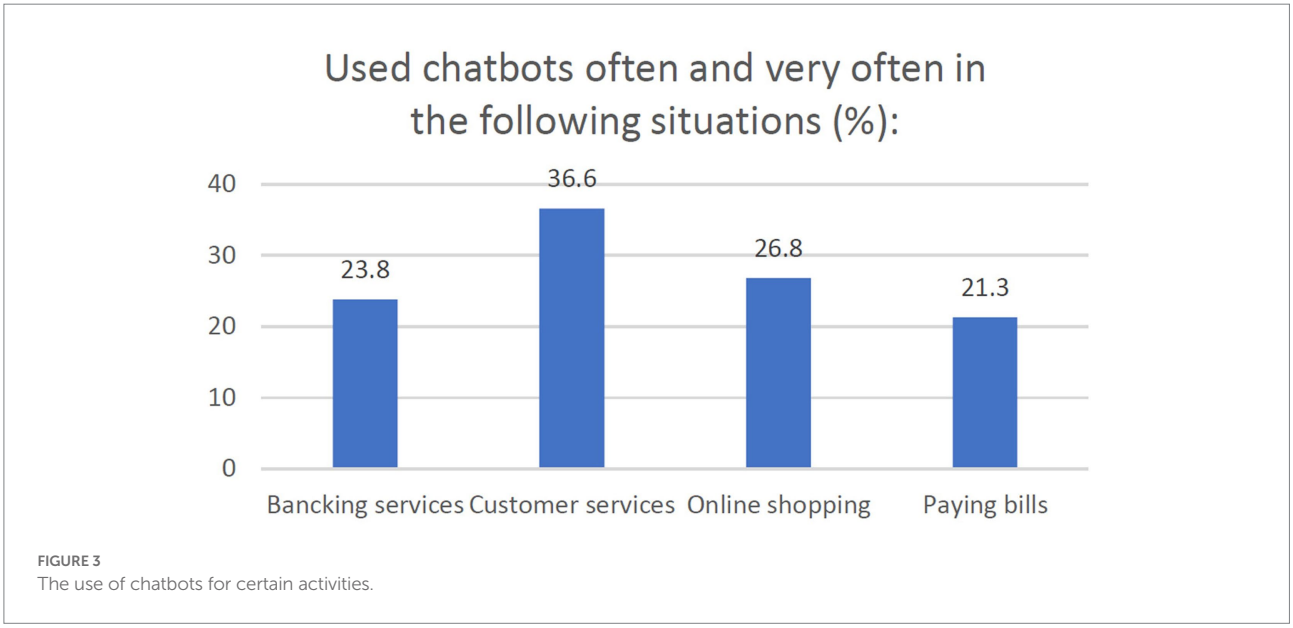

FIGURE 3
The use of chatbots for certain activities.

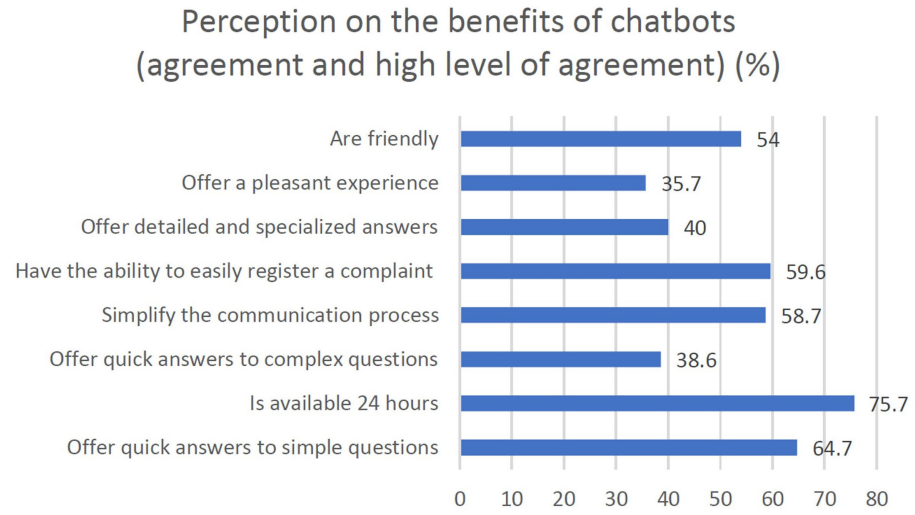

FIGURE 4
The perception of the benefits of chatbots.

TABLE 4 The descriptive statistics for Two-way ANOVA [the dependent variable is Behavioral intention (BI)].

Gender	Age	Mean	*SD*	*N*
Feminine	40–50	3.9713	1.7017	87
	51–78	4.125	1.8816	52
	Total	4.0288	1.7659	139
Masculine	40–50	4.2865	1.6348	48
	51–78	4.0156	1.7979	48
	Total	4.151	1.7146	96
Total	40–50	4.0833	1.679	135
	51–78	4.0725	1.8334	100
	Total	4.0787	1.7425	235

Behavioral intention to use a chatbot is not significantly impacted by perceived ease of use, age, gender, or the previous experience with the interaction (knowledge on chatbot, hearing of chatbot, use of chatbots, or like chatbots). Hence, hypotheses H3b, H3d, H3e, H3f, H3g, H4a, and H4b are not supported. However, perceived usefulness ($\beta = 0.113$, $t = 7.397$, $p < 0.001$) of a chatbot and subjective norms ($\beta = 0.255$, $t = 3.581$, $p < 0.001$) are positively and significantly impacting the behavioral intention of using this interaction in the future. Consequently, H3a and H3c are supported.

The square multiple correlation is $R^2 = 0.644$ for perceived ease of use. It means that 64% of the variance in the perceived ease of use is accounted by enjoyment, satisfaction, effort, competence, pressure, and perception of external control (however, only effort, competence, and perceived external control being significant). For the perceived usefulness, the square multiple correlation is $R^2 = 0.142$, which means that 14% of the variance in the perceived usefulness is explained by perceived ease of use and subjective norms. Finally, for the behavioral intention, the square multiple correlation is $R^2 = 0.571$. It means that 57% of the variance in the behavioral intention of using a chatbot is significantly accounted by perceived usefulness and subjective norms (perceived ease of use, age, gender, and experience variables not being significantly linked with behavioral intention).

The results of the structural model are summarized in the conceptual schema below (Figure 5).

Discussion and conclusion

In a context in which the technological development is increasingly impacting the socio-economic environment and in which the aging population is already an acknowledged phenomenon, the present paper aims to better understand the way chatbots are perceived by middle-aged and aging adults in Romania. Since the existing literature on chatbots is mostly written in the computer science domain and/or with a strong focus on healthcare and assistive perspective, one of the original contributions of this paper resides in assessing the general view, not domain-specific, on chatbots later in life and from a social science standpoint. Moreover, since most devices and applications are designed by young specialists, the aging adults' inputs are mandatory.

Starting from the COVID-19 pandemic situation, the need for digital solutions is emphasized (Valtolina and Marchionna, 2021). However, as older individuals are more reluctant to technology than youngsters (Edison and Geissler, 2003), investigating perception on technology later in life is paramount, not only thinking about the need for smart healthcare, but also considering daily routine activities, as paying a bill or shopping online.

TABLE 5 Correlation matrix.

	HC	UC	KC	LKC	PEOU	PU	ENJ	COMP	EFF	PRS	SA	PEC	SN	BI	Gender
HC	1														
UC	0.577**	1													
KC	0.480**	0.497**	1												
LKC	0.096	0.280**	0.281**	1											
PEOU	0.313**	0.370*	0.310**	0.423**	1										
PU	0.216**	0.396**	0.228**	0.584**	0.782**	1									
ENJ	0.141*	0.338**	0.192**	0.686**	0.496**	0.725**	1								
COMP	0.291**	0.370**	0.383**	0.497**	0.765**	0.653**	0.598**	1							
EFF	−0.037	−0.039	−0.092	0.002	−0.216**	−0.164*	0.096	−0.077	1						
PRS	0.309**	0.371**	0.334**	0.476**	0.664**	0.608**	0.485**	0.657**	−0.372**	1					
SA	0.163*	0.330**	0.179**	0.615**	0.547**	0.781**	0.783**	0.605**	0.000	0.538*	1				
PEC	0.415**	0.439**	0.419**	0.265**	0.528**	0.432**	0.303**	538**	−0.101	0.454**	0.343**	1			
SN	0.058	0.129*	0.001	0.225**	0.184**	0.363**	0.400**	0.202**	0.189**	0.055	0.407**	0.314**	1		
BI	0.249**	0.395**	0.243**	0.609**	0.519**	0.771**	0.728**	0.584**	0.024	0.477**	0.823**	0.432**	0.418**	1	
Gender	0.146*	0.183**	0.206**	0.091	0.070	−0.005	−0.013	0.037	0.077	0.037	−0.029	0.117	0.041	0.036	1
Age	−0.161*	−0.073	−0.112	−0.084	−0.209**	−0.158*	−0.071	−0.116	0.185**	−0.208**	−0.120	−0.103	0.089	−0.056	0.115

**Correlation is significant at the 0.01 level; *Correlation is significant at the 0.05 level.

HC, heard of chatbots; UC, used chatbots; KC, knowledge on chatbots; LKC, like chatbots; PEOU, perceived ease of use; PU, perceived usefulness; ENJ, enjoyment; COMP, competence/self-efficacy; EFF, effort/objective usability; PRS, pressure; SA, satisfaction/output quality; PEC, perception of external control; SN, subjective norms; BI, behavioral intention.

10.3389/fpsyg.2022.1111003

TABLE 6 The model fit summary.

MODEL	CMIN	Df	RMR	GFI	AGFI	NFI	RFI	IFI	TLI	CFI	RMSEA
Default model	21.57	14	0.063	0.989	0.891	0.99	0.912	0.996	0.967	0.996	0.048
	$p = 0.088$										
Recommended values for a good fit	$p > 0.05$	-	<0.08	>0.95	>0.90	>0.95	Close to 1	>0.90	>0.95	>0.90	<0.05

CMIN, chi-square value; Df, degrees of freedom; RMR, root mean square residual; GFI/AGFI, (adjusted) goodness OF fit; NFI, normed fit index; RFI, relative fit index; IFI, incremental fit index; TLI, Tucker Lewis Index; CFI, comparative fit index; RMSEA, root mean square error of approximation.

TABLE 7 The summary of the hypotheses testing.

Hypothesis	Estimate Standardized (β)	SE	CR (t)	P	R^2	Results
H1a: Enjoyment ➔ Perceive ease of use	0.007	0.075	0.11	0.912	0.644	Not supported
H1b: Satisfaction ➔ Perceive ease of use	0.121	0.07	1.83	0.067		Not supported
H1c: Effort ➔ Perceive ease of use	−0.138	0.047	−3.197	0.001		Supported
H1d: Competence ➔ Perceive ease of use	0.569	0.055	9.923	***		Supported
H1e: Pressure ➔ Perceive ease of use	0.079	0.049	1.6	0.11		Not supported
H1f: Perception of external control ➔ Perceive ease of use	0.124	0.045	2.71	0.007		Supported
H2a: Perceived ease of use ➔ Perceived usefulness	0.951	0.058	9.541	***	0.142	Supported
H2b: Subjective norms ➔ Perceived usefulness	0.806	0.15	4.434	***		Supported
H3a: Perceived usefulness ➔ Behavioral intention	0.908	0.113	7.397	***	0.571	Supported
H3b: Perceived ease of use ➔ Behavioral intention	−0.166	0.076	−1.579	0.114		Not supported
H3c: Subjective norms ➔ Behavioral intention	0.255	0.015	3.581	***		Supported
H3d: Knowledge on chatbots ➔ Behavioral intention	−0.014	0.053	−0.246	0.805		Not supported
H3e: Heard of chatbots ➔ Behavioral intention	0.103	0.068	1.883	0.06		Not supported
H3f: Use of chatbots ➔ Behavioral intention	−0.03	0.062	−0.491	0.623		Not supported
H3g: Like chatbots ➔ Behavioral intention	0.078	0.149	1.186	0.236		Not supported
H4a: Age ➔ Behavioral intention	0.047	0.172	0.997	0.319		Not supported
H4b: Gender ➔ Behavioral intention	0.015	0.067	0.345	0.73		Not supported

***$p < 0.001$.

By relying on complex theoretical models of technology acceptance, the present paper highlights the role of perceived ease of use of chatbots, their perceived usefulness, previous experience with chatbots and demographics on the behavioral intention to further use this type of interaction. A structural model has been used for hypotheses testing. The first assumption of the paper (H1) is introducing a wide range of variables as possible explanations for the perceived ease of use of chatbots. Chatbots are perceived as easy to use if the effort implied is low and if the users feel competent for this type of interaction. However, contrary to expectations, enjoyment, satisfaction, or pressure, although significantly correlated to perceived ease of use, are not directly influencing it. These results are contrasting a large set of findings on technology acceptance (Venkatesh, 2000; Zamora, 2017; Kim et al., 2018). Possible explanations might be related to the limits of the sample (in terms of number or over-representation of certain socio-demographical features, i.e., education), to the lack of knowledge on chatbots, or to a poor exposure to this type of technology. Thus, associating chatbots with different degrees of enjoyment, satisfaction, or pressure might be accomplished only after an adjustment time frame and an increased experience. Consequently, further investigation is needed on the way aging population perceive the ease of use of chatbots, a topic that is scarcely studied.

The second assumption (H2) of the paper implies that perceived usefulness of chatbots is predicted by the perceived ease of use of this technology and by the subjective norms. Data show that this hypothesis is supported. Thus, middle-aged and aging users consider that chatbots are useful mainly if they find them easy to be used, is people around them consider they should use this interaction, and if they are helped into this process. This

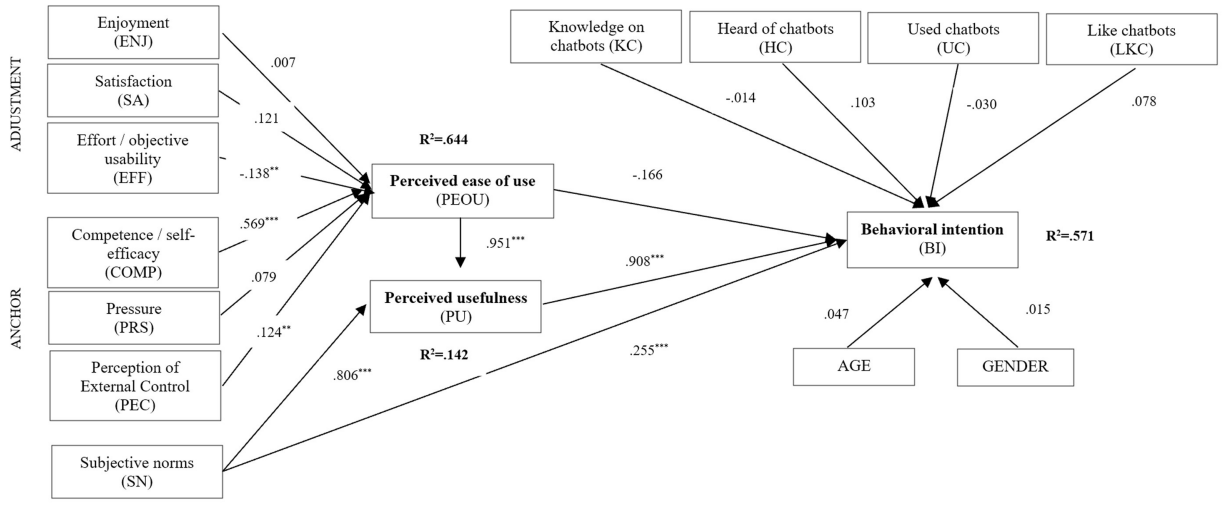

FIGURE 5
Results of the structural model.

conclusion is in line to the results of Venkatesh and Davis (2000) and Venkatesh and Bala (2008).

The third assumption (H3) is hypothesizing that behavioral intention is impacted by the perceived ease of use, perceived usefulness, subjective norms, and previous experience with chatbots. This assumption is based on the results of Venkatesh and Davis (2000), Lin et al. (2007), Renaud and Ramsay (2007), or Venkatesh and Bala (2008). The data show that, although there are significant correlations between all these variables, behavioral intention is only explained by the perceived usefulness of chatbots and by the subjective norms. In this respect, later in life, a more utilitarian perspective of technology and the role of peers seem to be more important.

Finally, the last hypothesis (H4) refers to the role of age and gender on the way further intentions to use chatbots are perceived. The data show that there are no relations between the way women or men, and middle-aged or aging adults are perceiving intentional behavior to use chatbots. This lack of difference seems to be acknowledged by Modahl (1999) that concludes that, mainly when it comes to internet use, the role of age and gender is reduced. In terms of age, the results can be explained by the low age average ($M = 51.13$) and by the fact that people above 60 years old are under-represented (8.2%) within the sample.

As studies on chatbots and aging adults are few and are mainly investigating reactions in the healthcare domain, this research is one of the first attempts to better understand the way chatbots in a not domain-specific context are perceived later in life. However, as some of the results are contradicting the existing theoretical models that explain technology acceptance, further inquiries are needed. One of the limits of the present paper is the small sample size and the convenience sampling method. Convenience samples are valuable for assessing attitudes and identifying new possible hypotheses that need further rigorous investigation (Galloway, 2005). In this respect, larger targets and a more in-depth approach should be investigated. Considering that age alone is not a socio-demographic sufficient variable to explain technology use (Loos, 2012), one important limit of the paper refers to the fact that aging adults that have rural residence, are less educated, and have low income are underrepresented in this study. To have a generalization potential of the results, future investigations should consider a better representation of the population within the sample for all the important socio-demographical variables. Likewise, as older people are not that comfortable with online questionnaires (Kelfve et al., 2022), doubled by a large range of statements investigated, the method might have created bias and desirability. It is very likely that an experimental setting would better fit the issue of chatbot testing. At the same time, a future comparative approach between the way not domain-specific chatbots and domain specific ones are perceived becomes of great interest. Another limit of the paper refers to single country study. Emphasizing the case of Romania and its specific digital literacy characteristics, the data cannot be generalized to any other socio-economic or cultural context. However, Romania, being ranked the last in digital skills among EU countries can serve as a valuable case-study for different techniques to overcome and improve the digital literacy gap. For a more comprehensive and global perspective, a comparative analysis with other countries is needed. Since assistive technologies are already largely used in developed countries, a best practice guide to reduce the economic and social gaps might be of great value.

The present paper's contributions are twofold. On one hand, it is one of the first attempts to explore the middle-aged and aging adults' perceptions on chatbots in a non-healthcare context in Romania. Considering that technology is increasingly present in our daily routine, this type of investigation is of great use. Furthermore, some of the variables included in other studies analyzing technology perception in different setups seem not that important in the case of chatbots' use later in life and in the context of the least digitally educated country in EU. In this

particular case, a lower degree of effort, an increased feeling of competence, external control and subjective norms, and a high utilitarian role of technology seem to be utmost factors in chatbots' use. Finally, it is important to notice the inexistant differences at the age and gender levels. Thus, stereotypical perceptions should be overcome.

On the other hand, the implications of the present investigation echo at the managerial and business level. As training might be uncomfortable for aging individuals, developing chatbots that are intuitive and that do not need much preparation to be used might be a winning solution (Da Paixão Pinto et al., 2021). The practitioners that develop technological interactive systems should be aware of the needs of the aging adults. Thus, the take aways imply designing useful technologies that do not require effort in use and that provide feelings of competence for the user.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not provided for this study on human participants because informed implicit consent was obtained when the survey has been conducted and the data was anonymized. The survey has been conducted online and the respondents opted in to participate. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Companion robots to mitigate loneliness among older adults: Perceptions of benefit and possible deception

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Objective: Given growing interest in companion robots to mitigate loneliness, large-scale studies are needed to understand peoples' perspectives on the use of robots to combat loneliness and attendant ethical issues. This study examines opinions about artificial companion (AC) robots regarding deception with dementia and impact on loneliness.

Methods: Data are from a survey of 825 members of the OHSU Research via Internet Technology and Experience cohort (response rate=45%). Sixty percent (n=496) of the age diverse sample (range=25–88; M=64; SD=13.17) is over 64, allowing us to compare across age and consider current and future older adults. Ordinal logistic regressions examined relationships between age, health, and other socio-demographic characteristics and perceptions of impact on loneliness and comfort with deception.

Results: Most participants (68.7%) did not think an AC robot would make them feel less lonely and felt somewhat-to-very uncomfortable (69.3%) with the idea of being allowed to believe that an artificial companion is human. In adjusted models, one additional year of age was associated with lower likelihood of perceived benefit of reducing loneliness [Odds Ratio (OR)=0.98; (0.97–0.99), p=0.003] and lower comfort with deception [OR=0.99; (0.97–1.00), p=0.044]. Being female was associated with lower likelihood of comfort with deception [OR=0.68; (0.50–0.93), p=0.014] and high confidence using computers with greater comfort [OR=2.18; (1.42–3.38), p<0.001].

Discussion: There was not strong support for AC robots to mitigate loneliness. Most participants were uncomfortable with this form of deception, indicating need for design solutions for those who want to avoid this possibility, as well as greater attentiveness to desirability and comfort across age and gender.

KEYWORDS

robotics, artificial intelligence, natural language processesing, dementia, ethics

1. Introduction

Social isolation among older adults during the coronavirus disease 2019 (COVID-19) pandemic has been termed "the double pandemic" (Holt-Lunstad, 2020). Attention is growing on new ways to mitigate loneliness for older adults and specifically people living with dementia, spurred by the

increased risk for loneliness among older adults due to the pandemic (Tam et al., 2021) and findings that dementia increases risk for loneliness (Sutin et al., 2020). In the context of social isolation and inadequate resources to meet elder care needs, artificial companion robots - devices that use AI to interact conversationally - have been developed to keep older adults company, among other functions (Jackson, 2019; Portacolone et al., 2020; Berridge et al., 2021; Coghlan et al., 2021; Engelhart, 2021; Sekhon et al., 2022). This is a topic increasingly relevant to aging services. In the United States, state aging departments have distributed AI-based robots to older adults in response to the challenges of meeting the socialization needs of isolated older adults during the pandemic (Zilber, 2022). The use of robots with older adults had received media attention prior to COVID, but this intensified during the pandemic (Jackson, 2019; Samuel, 2020). For example, a New Yorker article reported that a number of states started robot programs, some paid for by pandemic-relief funding, and that aging departments in 21 states have distributed more than 20,000 furry robot pets expressly to help lonely older people (Engelhart, 2021).

Most of the research has focused on pet-like robots that do not have natural language processing capability (Sekhon et al., 2022). A systematic review of 11 studies that examined non-speaking, primarily plush pet-like robots used with older adults living with dementia found that they have the potential to improve quality of life, agitation and anxiety, engagement and social interaction, loneliness, stress, and medication use, though the review determined the studies to be of low to moderate quality (Pu et al., 2019). Telepresence and non-pet-like robots have been successfully piloted in residential facilities with people living with dementia to serve as platforms for arts-based interventions (Fields et al., 2021). Small pilots with older adults living with dementia and/or depression suggest feasibility of AI-conversational robots (Abdollahi et al., 2017; Khosla et al., 2021); however, there is very little evidence that speaking, artificially intelligent companions either mitigate or contribute to social isolation or loneliness (Robillard et al., 2020).

A cross-sectional study of the effects of COVID-19 on perception of and intention to purchase a social robot found that loneliness was positively associated with reported willingness to buy a robotic companion (Ghafurian et al., 2021), indicating that people may perceive that a robotic companion could mitigate loneliness. Similarly, a study that predates the pandemic of non-AI robots, Paro and Giraff (telepresence), suggests a role for psychosocial functioning (depressive mood, loneliness, life satisfaction and social support) in robot acceptance among older adults (Baisch et al., 2017). A small study of robots use in dementia care found that participants were concerned that it could increase isolation for this group (Natarajan et al., 2022). However, the research that assesses opinions of potential users about AI companions' proposed benefit of mitigating loneliness is very limited, and small-scale studies cannot assess potential differences across groups.

The ethical issues related to the surveillance that artificial companions enable, deception, the potential for reduced opportunities for human interaction, and the difficulty achieving informed consent of people living with dementia are open topics of interest in academic journals (Vandemeulebroucke et al., 2018; Portacolone et al., 2020; Robillard et al., 2020). In a study on the risks and benefits of dementia care technologies in the U.S and Canada, a number of domain expert participants used the word "problematic" in reference to using AI for companionship (Berridge et al., 2021). Reported potential risks of using companion robots include reduced human interaction, increased isolation, depersonalization in robot relationships, frustration for people living with dementia caused by errors, confusion about where the voice is coming from, overreliance, and the risk of depriving people of meaningful connection (Berridge et al., 2021).

Portacolone et al. (2020) have argued that a core ethical problem is deception when older adults believe they are in a personal relationship with an artificial companion robot. Van Wynsberghe (2022) pinpoint the ethical problem as one of deception that a robot is deserving of reciprocity, which is enabled through the form and responsive capabilities designed into it. The possibility of deception, particularly when dementia is present, has received attention both in the popular media and the academic literature. Itis a particularly compelling challenge.

Vandemeulebroucke et al. (2018) suggest that all stakeholders in aging services should have a voice in the discussion to complement ethical assessments and ethical reflection. Robillard et al. (2020) have specifically called for more empirical research on the attitudes of older adults toward deception with fully automated robotics that seem human-like or human-controlled to inform the ethical debate. They explain why preventing deception of people living with dementia may not be as simple as controlling form design, and they argue that efforts to do so to prevent harm should be informed by stronger evidence of possible harm (Robillard et al., 2020). Deception in the form of mismatch between appearance and source (i.e., AI with human voice in pet-like form or a human remotely speaking and visually represented vs. represented by an animal avatar) is not the only form of deception. Robillard and colleagues cite evidence that emotionally responsive assistive technologies for older adults may be more effective than those without affect expression capability and point out that "people have a strong tendency to read human-like intent into many different types of technological artifacts" (Robillard et al., 2020). Leong and Selinger (2019) build on the principle of "honest anthropomorphism" (see Kaminski et al., 2017) with a taxonomy of forms of what they term "dishonest anthropomorphism" to which humans are inherently vulnerable (Leong and Selinger, 2019). This refers to misalignments between the capabilities of a robot and the assumptions a person makes about that robot's capabilities. This misalignment takes many forms, such as in human responses to the particular voice chosen for the robot and expression by the robot of non-existent emotion, opinion or attitudes. These issues are heightened by very recent developments such as Amazon's Alexa's voice assistant's new demo feature of recreating human voices from audio clippings, including those of deceased individuals (Paul, 2022). Amazon's stated goal of this feature was "to build greater trust with users by infusing artificial intelligence with the human attributes of empathy and affect" Rohit Prasad as cited by Paul (2022). Leong and Selinger's (2019) taxonomy of "dishonest anthropomorphism" raises complex questions that are increasingly relevant to real-world decisions, such as how do these misalignments promote inappropriate levels of trust? These open issues have important implications for privacy, autonomy and boundary management (Berridge, 2016; Leong and Selinger, 2019).

The current study examines among a large online cohort of adults in the United States, opinions about the potential of AC robots to mitigate loneliness and comfort with possible deception with their use in the context of dementia. We further examine how these opinions and comfort levels vary by key socio-demographic characteristics. This article reports on whether respondents think an AC robot would help address loneliness for them, as well as how they feel about deception with dementia, should they believe that the voice of an AC is a real human. We analyze free text comments on the survey that provide

nuance and further insight to a range of feelings people express about AC robots.

2. Methods

2.1. Study design and population

The 19-item survey that we report data from was administered using Qualtrics and disseminated by email in June of 2020 to the online survey cohort of the Research via Internet Technology and Experience (RITE) program of the Oregon Center for Aging & Technology (ORCATECH) at Oregon Health & Science University (OHSU) University. Volunteers in this cohort are adults who complete topical surveys quarterly about technology and health and wellness. The RITE online cohort was launched in 2015 to identify and track attitudes and preferences of technology use in healthcare over time. The current study used the full sample of 2,434 volunteers registered as active in 2019. The RITE cohort had no inclusion criteria other than being over the age of 18. Volunteers were primarily recruited through direct email invitations using OHSU's Oregon Clinical and Translational Research Institute's (OCTRI) Cohort Discovery, which interfaces with OHSU's EPIC electronic medical record data repository maintained by OCTRI. Social media campaigns and flyers were secondary recruitment strategies. RITE volunteers completed online an initial packet immediately after consent (OHSU IRB # IRB00010237) and an annual online survey to report changes to the information gathered in their initial packet. The full cohort of 2,434 members was sent the online survey and 1,082 completed it (response rate = 45%).

Two respondents were not living in the community and were thus excluded, as were those without data for four core variables: gender (missing = 72), age (missing = 4), education (missing = 150), or memory problem history (missing = 179), leaving an analytic sample of 825 respondents. The rate of missing value for each of the other covariates were each below 10% (0.1–9.1% for the variable of history of dementia in parents). Gender was recorded in the initial intake for the RITE cohort as a binary response option of male and female and a write-in option. We coded those who wrote in transgender man or woman with male and female and excluded for analysis the six people whose written-in responses fell broadly under categories such as gender diverse and questioning, discussed further in the limitations section. Because we omitted from our sample the 16% of participants who had missing values for the key variable of interest, reported history of memory problems, we conducted sensitivity analyzes stratifying by each outcome.

2.2. Dependent variables

The survey introduced companion robots in the following way: "Interest is growing in artificial intelligence that is built into robots. Robots can be made to look like animals or humans. One use for these robots is to provide companionship because these robots can hold conversations with people." To make this concrete for participants, two example images were provided: one of the products called GenieConnect and one of ElliQ. Participants were asked, "If you were feeling lonely, do you think that an artificial companion that can talk with you would make you feel less lonely?" (Definitely No, Probably No, Probably Yes, and Definitely Yes), and "If you had dementia, how comfortable would you be with your primary support person letting you believe that an artificial companion is a real human?" (Very Uncomfortable, Somewhat Uncomfortable, Somewhat Comfortable, Very Comfortable). Each response option was labeled for consistent interpretation. Please see Supplementary Material for these survey questions. Participants were also provided with an open response comment option at the conclusion of the survey with the prompt, "Do you have any comments you'd like to share?"

2.3. Independent variables

Health and demographic information was pre-collected through the RITE cohort surveys. Characteristics previously associated with comfort and preferences for digital technologies were included in analyzes, including memory problem history (Charness and Boot, 2009), which is a yes response if answered yes to one of two questions about (1) presence of self-reported current memory problems or (2) if the participant has been seen by a physician for memory problems. We included age (Thordardottir et al., 2019), gender (Lai et al., 2010; Gell et al., 2015), marital status (Gell et al., 2015; Abd-Alrazaq et al., 2019), living status (Lai et al., 2010), education (Lai et al., 2010; Gell et al., 2015), number of chronic conditions (Chappell and Zimmer, 1999; Lai et al., 2010), confidence of using computer (Czaja et al., 2006), and social support (Baisch et al., 2017) defined as level of social activity using the Brief Assessment of Social Engagement scale (0–20) (Morgan et al., 1985). Because we are interested in examining potential differences by memory status, we included memory problem history, as well as history of dementia in parents because these might indicate respondents' perceived risk of acquiring dementia (Kessler et al., 2012) and because the perspective gained about dementia may be influential on these questions of interest. We also included pet ownership because that experience might impact one's feelings about living and interacting with a non-human companion, such as a small robot. There is insufficient variability for analysis by race and ethnicity: 95.9% of respondents were white and 98.5% were non-Hispanic, discussed further in the limitations section.

2.4. Analysis

Analyzes were performed using R software (R Core Team, 2013). Bivariate and multivariate ordered logistic regressions (Bilder and Loughlin, 2014) were performed using the R package "MASS" (Ripley, 2011) and "ordinal" (Christensen and Christensen, 2015) to determine whether there were relationships between independent variables and dependent variables that are ordinal (Long and Freese, 2006). Brant tests were used to test the assumption of proportional odds (UCLA, Statistical Consulting Group, n.d.). To better understand how different critical factors drive the specific trends, we conducted post-hoc interaction analysis on variables that are significantly associated with outcome variables in bivariate and multivariate analysis. As shown in the Supplementary Material Table, for both outcomes, we examined possible interactions between age and education, education and memory problem history, and gender and memory problem history.

After completing the survey questions about AC robots, participants were asked to provide their comments in an open text box. Thematic analysis was conducted on these qualitative responses provided by 315 participants (38%) (Nowell et al., 2017). Two members of the research team read all the responses and separately developed initial codebooks.

They met to merge their codes into a single codebook and to refine it. They then separately coded the comments and met to discuss all discrepancies where codes were differently applied until they reached consensus about final coding (Nowell et al., 2017). Seven themes were identified that relate to the issues of loneliness mitigation and deception. Below, we present frequencies for prominent themes along with exemplary comments.

3. Results

3.1. Participant characteristics

Table 1 presents participant characteristics. Participants ranged in age from 25 to 88, but the sample skewed older with a mean of 64-years-old (SD = 13.17). Sixty-five percent identified as female and 35% as male and 70% were married or living as if married, while 20% lived alone. One quarter had no college degree, one third had a college degree, and 42% had a master's degree or more. About one quarter reported having memory problems and 68% had 3 or more chronic conditions. Thirty percent had a parent with a history of dementia. The majority (84%) were highly confident using computers, with only about 16% reporting moderate to low confidence. Sixty-two percent reported interacting often with a pet and the sample's mean social activity score was 8.47 (range = 0–17; SD = 2.82) with a maximum possible of 20.

3.2. Survey responses

Most participants did not think an artificial companion that can talk would make them feel less lonely. As depicted in Table 2, those older than 64 were even less likely than their younger counterparts to think it would help with loneliness. One quarter (25.3%) of the full sample definitely did not, while only 3.2% definitely did. 43.4% responded that it probably would not and 28% thought it probably would make them feel less lonely. Most participants were either very uncomfortable (43.6%) or uncomfortable (25.7%) with their primary support person letting them believe that an artificial companion is a real human if they had dementia. About one fifth (21.9%) were somewhat comfortable and 8.8% were very comfortable with this.

TABLE 1 Participant characteristics.

Category	Subcategories	Mean/SD/frequencies	Percentage (%)
Age (n = 825)	Range: 25–88	Mean = 63.93 SD = 13.17	
Gender (n = 825)	Female	534	64.7
	Male	291	35.3
Race/ethnicity (n = 819)	Non-Hispanic white	776	94.7
	Non-Hispanic Black	6	0.7
	Hispanic	11	1.3
	American Indian or Alaska Native	5	0.6
	Asian	10	1.2
	Others	11	1.3
Marital status (n = 820)	Married/living as if married	577	70.4
	Not married	243	29.6
Living status (n = 824)	Living alone	162	19.7
	Living with others	662	80.3
Education (n = 825)	No college degree	202	24.5
	College degree	276	33.5
	Master's degree and above	347	42.1
Memory problem history (n = 825)	Memory problem reported	201	24.4
	No memory problem reported	624	75.6
Number of chronic conditions (n = 790)	3+	540	68.4
	0–2	250	31.6
Confidence using computer (n = 792)	Highly confident	668	84.3
	Low-moderately confident	124	15.7
History of dementia in either parent (n = 750)	Yes	226	30.1
	No	524	69.9
Interaction with pet (n = 812)	Often interact with pet (daily, weekly, monthly)	503	61.9
	Do not often interact with pet (yearly, rarely, or never)	309	38.1
Social activity level score (n = 800)	Range: 0–17 (out of 20)	Mean = 8.47 SD = 2.82	

10.3389/fpsyg.2023.1106633

TABLE 2 Response frequencies, *n*=825.

If you were feeling lonely, do you think that an artificial companion that can talk with you would make you feel less lonely?				
	Definitely no *n* (%)	Probably no *n* (%)	Probably yes *n* (%)	Definitely yes *n* (%)
65 +	137 (28.4)	231 (47.8)	103 (21.3)	12 (2.5)
<65	67 (20.7)	119 (36.8)	123 (38.1)	14 (4.3)
Total sample	204 (25.3)	350 (43.4)	226 (28.0)	26 (3.2)
If you had dementia, how comfortable would you be with your primary support person letting you believe that an artificial companion is a real human?				
	Very uncomfortable *n* (%)	Somewhat uncomfortable *n* (%)	Somewhat comfortable *n* (%)	Very comfortable *n* (%)
65 +	235 (48.9)	116 (24.1)	97 (20.2)	33 (6.9)
<65	115 (35.7)	90 (28.0)	79 (24.5)	38 (11.8)
Total sample	350 (43.6)	206 (25.7)	176 (21.9)	71 (8.8)

Respondents over age 64 were less comfortable than were younger respondents with this form of deception (see Table 2).

In bivariate analysis, each year of greater age was associated with lower likelihood of believing that AC robots would reduce loneliness [OR = 0.98 (0.97–0.99), $p < 0.001$]. Those with a master's degree or higher were also less likely to perceive the benefit of AC robots in reducing loneliness [OR = 0.69, (0.50,0.96), $p = 0.026$], as were those with 3+ chronic conditions compared with those with fewer than 3 [OR = 0.63 (0.47–0.83), $p = 0.001$]. Participants reporting a history of memory problems were more likely to perceive this benefit [OR = 1.37 (1.01–1.85), $p = 0.043$].

Higher age [OR = 0.99 (0.97–0.99), $p < 0.001$] and greater number of chronic conditions [OR = 0.64 (0.48–0.84), $p = 0.002$] were also negatively associated with comfort with deception. Greater computer confidence was associated with greater comfort with deception [OR = 2.26 (1.54–3.36), $p < 0.001$] (Table 3).

In multivariate analysis, unlike in bivariate analysis, those with a history of memory problems, 3+ chronic conditions, and those with master's degrees and higher were no different from their counterparts in their perception of AC robot potential to help them feel less lonely. Greater age continued to be negatively associated with perceived benefits of AC reducing loneliness [OR = 0.98, (0.97,0.99), $p = 0.003$], and deception related to AC [OR = 0.99; (0.97, 1.00), $p = 0.044$]. This means that with each 1 year of additional age, people have a 2% lower likelihood of believing that AI will reduce loneliness for each level (definitely no versus probably no, probably no versus probably yes, and probably yes vs. definitely yes), controlling for other variables. One additional year of age is associated with a 1% lower likelihood of being comfortable with deception; that is, to report very comfortable versus somewhat comfortable, somewhat comfortable versus somewhat uncomfortable, and somewhat uncomfortable versus very uncomfortable. In multivariate analysis, being female vs. male was associated with lower comfort with deception [OR = 0.68, (0.50–0.93), $p = 0.014$]. As with our bivariate analysis, controlling for other factors, people reporting high confidence using the computer were more than twice as likely to report greater comfort with AC deception [OR = 2.18; (1.42, 3.38), $p < 0.001$].

Significant interaction effects were found among education, age, gender, and memory problem history. There was an interaction effect of age and education level on participants' perceived benefits of AC robots in reducing loneliness (Supplementary Table S1; Model 1). Only among participants who had a master's degree was age significantly associated with a lower likelihood of perceiving the benefits of AC robots in reducing loneliness (master's degree: OR=0.96, [0.95,0.98], $p<0.000$; college degree: OR=0.99, [0.97,1.01], $p=0.210$; no college degree: OR=0.99, [0.97,1.02], $p=0.625$). There was also an interaction effect of gender and memory problem history on participants' perceived benefits of AC robots in reducing loneliness (Supplementary Table S1; Model 2). For male participants, there were no significant associations between memory problem history and this perceived benefit (OR=0.84, [0.48,1.48]. $p=0.542$). However, among female participants, having a memory problem history was significantly associated with a higher likelihood of perceiving that AC robots could reduce loneliness. Only among participants who had no college degree was having a memory problem history significantly associated with a higher likelihood of perceiving the benefits of AC robots in reducing loneliness (no college degree: OR=2.72, [1.36, 5.41], p=0.005; college degree: OR=1.23, [0.70, 2.17], p=0.474; master's degree: OR=1.02, [0.60,1.74]. p=0.949).

3.3. AC robots in participants' own words

Themes derived from comments offered by 38% of the participants provide insights into their feelings about this use of AC robots. The most commonly raised issue ($n = 45$) was regarding the invasion of privacy and perception that AC robots that rely on and collect audio data constitute over monitoring. This issue was often coupled with statements about data security, third party use, and possible data exploitation as unresolved problems that were cause for concern. Another common theme in the comments (32) was that human experiences cannot or should not be replaced, with concern over potential loss of real human interactions, meaning, affection, empathy and compassion. This participant's comment echoes a common sentiment: "One of the problems I see with how we care for the elderly is the lack of contact with others. I am afraid that these measures would lead to less and less human contact for these folks. It might become easier and cheaper for the care system to use these measures and for our elderly to become more and more isolated." Others (15) acknowledged positive potential uses of AI-enabled robots to assist with physical tasks and drew a line at social interaction: "After using Google Home (a very simple robot), I am familiar with talking to 'technology' and have no problem using it to control things around my home. However, social interaction is a different thing, and although I think I know how I would feel about having a tech buddy, I'm not sure how I would feel if I actually interacted with one. Being a retired techie, I use a lot of tech to make my life easier and try to stay up to date, so I do not have an aversion to using it but feel that human to human interaction is also very important." Some

10.3389/fpsyg.2023.1106633

TABLE 3 Bivariate and multivariate ordinal logistic regression.

	Perceived benefit of AC robots reducing loneliness		Comfort with deception	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age	0.98***	0.98**	0.99***	0.99*
	(0.97–0.99)	(0.97–0.99)	(0.97–0.99)	(0.97–1.00)
Female (vs. Male)	1.10	1.00	0.78	0.68*
	(0.84–1.43)	(0.73–1.36)	(0.61–1.00)	(0.50–0.93)
Married/living as if married (vs. Not married)	0.85	0.83	1.10	1.17
	(0.64–1.13)	(0.51–1.34)	(0.83–1.46)	(0.72–1.90)
Living alone (vs. Living with others)	0.99	0.98	0.81	1.09
	(0.71–1.37)	(0.55–1.74)	(0.58–1.11)	(0.62–1.94)
College degree (vs. No college degree)	0.74	0.87	1.01	1.15
	(0.53–1.04)	(0.59–1.27)	(0.72–1.42)	(0.78–1.71)
Master's degree and above (vs. No college degree)	0.69*	0.76	1.20	1.25
	(0.50–0.96)	(0.52–1.11)	(0.86–1.67)	(0.85–1.83)
Memory problem history (vs. No history reported)	1.37*	1.38	1.17	1.15
	(1.01–1.85)	(0.99–1.94)	(0.87–1.57)	(0.82–1.62)
3+ chronic conditions (vs. 0–2)	0.63**	0.79	0.64**	0.78
	(0.47–0.83)	(0.56–1.10)	(0.48–0.84)	(0.56–1.10)
High confidence in using computers (vs. Low-moderately confidence)	1.35	1.16	2.26***	2.18***
	(0.94–1.93)	(0.78–1.73)	(1.54–3.36)	(1.42–3.38)
History of dementia in parents (vs. No history of dementia in either of parents)	0.76	0.95	1.05	1.19
	(0.56–1.01)	(0.70–1.31)	(0.78–1.40)	(0.87–1.63)
Often interact with pet (vs. Not often interact with pet)	1.06	0.85	1.10	1.00
	(0.82–1.38)	(0.63–1.16)	(0.84–1.43)	(0.74–1.36)
Social activity level score	0.97	1.00	1.01	1.03
	(0.93–1.02)	(0.95–1.06)	(0.97–1.06)	(0.98–1.09)

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

participants (22) specified that they would prefer to have a human or a pet over an AC robot.

Twenty-three people focused their comments on ethical problems, including but not limited to the issue of deception, or they wrote that AC robots are troubling, disturbing, dangerous, or a slippery slope that would undermine care. As one explained, "All of these artificial companions provide the illusion of intimacy without actual intimacy. That's dishonest - and creepy." Like a small number of others, this participant offered that AC robots are the wrong solution to the problem: "The answers to the problems implicit in these prompts cannot be found on robots - they can only be found in the difficult, and necessary, work of restructuring our society so that people who need it always have in-person support." Another suggested, "We need to temper AI with HI-Human Intelligence systems that are financially supported and that provide healthy human interactions rather than pretending that Alexa is your 'friend.' That is AI jail keeping, not community building."

Another common theme was not being able to project how one would feel if they acquired dementia, or that it would depend on a number of health and functioning realities. For example, a participant wrote, "I think that the answers to several of these questions would be different depending on whether I could talk, my level of dementia, and other factors. It is hard to decide in a vacuum." This idea that decisions about AC should be contextualized was commonly noted. Another 16 projected that if they had dementia, they would not have an opinion or care about how AC robots were used with them.

4. Discussion

This survey research conducted with an online community with a variety of health and socio-demographic factors provided a unique opportunity to learn about the perceived impact of AC robots on loneliness and the level of comfort with deceiving people with dementia that the talking robot is not human. Aligned with much of the ethics conversations about deception, most participants were uncomfortable with their primary support person letting them believe that an AC is a real human if they had dementia.

People reporting a history of memory problems or history of a parent with dementia were no more likely to be comfortable or uncomfortable with this form of deception. This is an interesting finding that is consistent with a very small body of research suggesting little to no difference in comfort with monitoring technology or data collection

according to mild cognitive impairment status (Boise et al., 2013). It indicates that despite perceived vulnerability, countervailing factors may be at play for those who are concerned about potential memory difficulties, perhaps including consideration for dignity, autonomy loss, or desire for control (Mcdonald and Mentis, 2021); however, this is only speculative and requires further research to understand the considerations underlying this finding of no difference. This is a particularly important area for future research because companion robots are developed for use with people living with dementia with potential benefits of stimulating cognitive engagement, enabling people to use their language functions, as well as experience interactions that are free from human responses of impatience with repetition. However, domain experts and ethicists caution that the use of AC robots could deceive and confuse the person living with dementia about where the voice is coming from, as well as potentially deprive people of meaningful conversation and lead to depersonalization (Berridge et al., 2021). This study's participants, the majority of whom were over the age of 64, provides important insights into how potential users feel about this ethical issue; however, while many reported experiencing memory issues, these participants were not living with dementia. In comments, some participants described their difficulty projecting out how they would feel about deception should they acquire dementia, noting that it would depend on numerous factors and the decision should be contextualized. It is thus critical that people who are living with mild cognitive impairment (MCI) and dementia be included in these conversations. Our findings also indicate that it will be important to examine potential differences by gender among older adults with MCI and dementia, including explanations for what impacts those differences, and how to address them accordingly (i.e., through product design and practices).

In bivariate analysis, higher age and greater number of chronic conditions were associated with lower comfort with this form of deception, while greater computer confidence was associated with greater comfort with it. Controlling for other variables, higher age and identifying as female (vs. male) were each associated with lower comfort, while high confidence using computers remained associated with greater comfort. We found a positive relationship between high confidence using computers and comfort with being allowed to believe, that an AC robot is a human. It is possible that this indicates that greater trust or reliance on computers may accompany higher feelings of mastery or competence in relation to other digital technologies. This requires more systematic analysis than our reported comments provided of the reasons people feel comfort or discomfort with this form of deception.

These findings regarding age and gender are consistent with other research on comfort with data collection and sharing generally, which reports those who identify as female are less comfortable than are males with various types of data collection about them, potentially due to greater risks or sense of vulnerability to online abuses or exposures (Li, 2011; Matthews et al., 2017; Messing et al., 2020; Berridge et al., 2022). While this form of deception is a different kind of data flow question than personal data sharing preferences, they may both reflect greater weight placed on maintaining a level of control or greater perceived vulnerability to consequences of lacking control. This difference was not assessed qualitatively, so we can only speculate. It should be more closely examined to understand why and how interventions could be responsive to the concerns and needs of female-identified older adults, as well as people with gender identities that were not captured in this study (e.g., non-binary). The association of higher age with lower comfort with this form of deception is important to understand in light of the fact that women make up the majority of older adults, and an even greater proportion of those over age 85.

Regarding impact on loneliness, the majority did not perceive that AC robots would make them feel less lonely, and this did not differ in adjusted models if a person had family histories of dementia. We were interested in potential differences between those with and without a reported memory problem history and found that reporting memory problems was associated with perceiving this benefit in bivariate but not multivariate models. Also in bivariate analysis, both higher age and higher education were associated with lower belief that an AC robot would reduce loneliness, as was having 3+ compared with fewer chronic conditions. Only higher age remained associated with this lower perceived benefit in adjusted models.

For this outcome of perceived benefit of reducing loneliness, there were interaction effects of age and education level, gender and memory problem history, and education and memory problem history. The association between greater age and lower perception of this benefit is stronger among those with the highest level of education compared with those with the lowest. For female participants, reporting a memory problem history was associated with greater likelihood of perceiving this benefit than for those without such a history, whereas for male participants, reporting a memory problem history was not significantly associated with their likelihood of perceiving this benefit. Additionally, for those with the lowest level of formal education, reporting a memory problem history was significantly associated with greater likelihood of perceiving this benefit than it was for those without such a history; such association was significantly greater than it was for those with the highest level of education. These findings imply that future research should closely examine how these characteristics (gender, age, education and memory status) interrelate and impact desire for AC robots and, if implemented, impact on loneliness.

Participants most often offered comments expressing concerns over privacy invasion, data use, and lack of security of data used by AC robots. These echo concerns raised in the literature about the ethical issues related to surveillance enabled by AC robots (Vandemeulebroucke et al., 2018; Portacolone et al., 2020; Robillard et al., 2020), as well as calls for regulation to address data use (Berridge et al., 2021). Free form comments also provide insight into survey findings to the extent that participants preferred task-oriented robots over companion-purpose robots, though the technological capacities of robotics are not nearly refined enough to realize task completion (Maibaum et al., 2022). Preference was expressed for human or pet companionship. These comments are consistent with other studies that found either rejection of robots that pretend to be companions (Deutsch et al., 2019) or desire for companionship only as a secondary but not primary function (Coghlan et al., 2021).

Many of the optional comments further expressed the belief that robots cannot or should not substitute for human care, contact, or touch. Some offered poignant statements about this being the wrong solution to the problem, which they described as deserving of societal restructuring and greater investment in provision of needed in-person supports. Others felt that use of AC robots may further entrench the problem of social isolation among older adults or create the "illusion of intimacy without actual intimacy." These concerns that align with those raised in the literature suggest that care systems do not become dependent on artificial companionship to attempt to meet needs for human contact, mutuality, and touch. Participants expressed interest in

robots that could perform a task or function but were less optimistic that AC robots could provide meaningful support to someone experiencing loneliness. Limitations.

In this study we did not examine whether self-report of loneliness impacts these attitudes toward AC robots. The study sample is 95% white and lacks racial and ethnic diversity, as well as diversity in digital access and literacy, given that this is an online cohort. This sample has above average levels of technological experience as an online cohort and more formal education. As part of intake into the cohort, participants were asked a question about the extent to which their material needs in their adult life have been met. We analyzed our sample's responses to this question and found too little variation to include it in our models. The vast majority responded that their food, housing, clothing and medical needs have been met. We did not collect income data, but the distribution of this material needs question would suggest that the sample is more financially resourced than the average person in the U.S. Their concerns and preferences may differ from that of the general population. It is also possible that their greater access to digital technologies may make them more aligned in preference and comfort with an early adopter population.

Our measure of memory concerns is derived from two self-reported survey questions. It does not imply a diagnosis of dementia or mild cognitive impairment. The proportion in our sample who reported memory concerns is consistent with population surveys about memory loss concerns (Cooper et al., 2011; Vlachos et al., 2019). Research is also needed with people living with dementia about their perceptions of these issues. We did not oversample those who identify, as six of our respondents did, under the umbrella of gender diverse or questioning, and were thus unable to conduct analysis with this small group. Surveys with more gender diversity representation are needed to better understand and address potential differences by gender, as ours was limited to a binary male/female comparison that does not reflect gender diversity. Finally, perceptions and beliefs may not translate to actual experiences. Nevertheless, these findings provide a snapshot of a non-expert population's personal ethical assessments of two understudied issues.

5. Conclusion

This finding that the majority of respondents did not think an AC robot would help them with loneliness and that this negative appraisal was associated with greater age appears inconsistent with the purported benefit of AC technology for older adults. These findings suggest that greater potential exposure to isolation that older adults face in general might not result in greater acceptance of AC robots to address loneliness. Given the concerns highlighted by a number of participants, it is particularly important that implementation does not get too far ahead of user centered design where older adults, are engaged in the design of interventions so that they are responsive to what older adults want robots to do for them, and policies may then protect the rights and interests of older adult users. Artificial companion robots are targeted on a problem that is not technical in nature (social isolation), so this is particularly important. These responses can inform how we study the impact of social robots and the types of questions we must ask to maximize benefits of robotic and natural language processing capabilities to older adults without reducing human interaction or otherwise causing harm.

Data availability statement

The datasets presented in this article are not readily available because informed consent was not obtained by participants to share their data with others. Requests to access the datasets should be directed to clarawb@uw.edu.

Ethics statement

The studies involving human participants were reviewed and approved by University of Washington Human Subjects Division. Written informed consent for participation was not required for this study in accordance with the institutional requirements.

Author contributions

CB in consultation with JR and JK created the survey. YZ and CB analyzed the data and drafted the manuscript. JR, JK, and YZ edited and reviewed the manuscript. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1106633/full#supplementary-material

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Optimising conditions and environments for digital participation in later life: A macro-meso-micro framework of partnership-building

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The ongoing digitalisation of societies, exacerbated by the COVID-19 pandemic, has led to increased efforts to ensure the digital inclusion of older adults. Digital inclusion strategies throughout the COVID-19 pandemic predominantly focused on increasing access and basic digital literacy of Information and Communication Technologies (ICTs) for all members of society. Older adults, who are more likely to experience digital exclusion, are amongst the target groups of digital inclusion strategies. We propose that beyond digital inclusion, there is a need to focus on digital participation and optimise opportunities for everyone to participate in communities and society in post-pandemic times. Creative digital skills are the foundation of digital participation and can lead to a variety of contributions. Digital participation offers conditions that support agency and active contributions in a digitalised society. Taking macro-, meso-, and micro-level enablers of digital participation in later life into account, we argue for the establishment and implementation of multi-layered and multisectoral partnerships that address environmental factors (including social and physical dimensions) of digital participation and create opportunities for diverse, meaningful and fulfilling engagement with ICTs in later life. The partnership approach can be used in designing and implementing digital participation programmes and should be further evaluated against the needs and lived experiences of older individuals. Foresighted research is needed to investigate key factors of effective partnerships for optimising environments for digital participation in later life.

KEYWORDS

community development, digital participation, environments of ageing, multistakeholder and multisector collaboration, partnership building

1. Introduction

The intersecting trends of population ageing and digitalisation have resulted in a focus on digital technology and later life. In highly digitalised countries such as Sweden, there is a high use of Information and Communication Technologies (ICTs) amongst older age groups. About 80% of people aged 66 years and over in Sweden are Internet users (The Swedes and the Internet, 2021). In many countries, digital inclusion programmes have been offered to older adults (Davidson, 2018; Hunsaker and Hargittai, 2018; Olsson et al., 2019; United Nations, 2020). The

primary goal of digital inclusion programmes is to improve the accessibility of digital public services (Davidson, 2018). Despite the availability of inclusion programmes, experiences of digital technology in later life may differ significantly based on age, gender, race/ethnicity, geographic location, socioeconomic status, lifestyle and their intersecting effects (Hunsaker and Hargittai, 2018). Older adults are a heterogenous group in the digital world with various understandings of digital technology and different levels of knowledge, skills, abilities, and resources for digital technology use. However, research on digital inclusion in later life has not adequately reflected the manifold ways in which older adults experience digital technologies (Vines et al., 2015; Reuter et al., 2020b). To improve our understanding of the diverse use of digital technologies in later life, individual needs, preferences, and concerns in a digitalised society need to be recognised and different ways of and conditions for digital participation in later life should be investigated.

During the COVID-19 pandemic, community-based participation shifted from in-person activities towards digital spaces (Pantić et al., 2021). Public health measures, such as lockdowns, accelerated the digitalisation of civic activities (Budd et al., 2020; Mao et al., 2021). This development towards a digitalised civic life posed challenges to older individuals who wished to remain civically active. It also highlighted limitations of a digital inclusion approach, which in its current form focuses on digital accessibility, affordability, and literacy, rather than on the creative skills needed to support older adults' active involvement and contributions in digitalised society. Whilst digital inclusion is one of the foundations for civic participation and social inclusion in later life (Milenkova and Lendzhova, 2021), active digital participation in later life remains under-explored (Serrat et al., 2020). Digital participation focuses on active involvement in digital society through the use of ICTs, with digital inclusion and accessibility merely representing two elements of the concept (Seifert and Rössel, 2022). Creative digital skills, such as skills to create digital content, are needed to achieve active involvement. The concept of digital participation acknowledges digital inequities and whether older adults participate actively or passively in digital society depending on usage, skills, social support, and self-perceptions (Seifert and Rössel, 2022). Indeed, participatory digital skills have become more important throughout the COVID-19 pandemic due to the shift from in-person participation into digital spaces. Expanding debates on digitalisation and ageing towards a focus on digital participation is an opportunity to further improve the lives of older adults in a digital society.

In the post-pandemic context, the digital lives of older adults may be improved using two approaches. The first approach is to continue to tackle digital inequities by promoting digital inclusion with the goal to improve digital access and digital literacy, which may be prerequisites for social inclusion in some contexts. This encompasses the continuous provision of accessible and affordable technology, and the training of basic digital skills required to navigate relevant services safely [United Nations Economic Commission for Europe (UNECE), 2021] The second approach is to create inclusive and diverse opportunities for older adults to participate digitally in communities and society. This encompasses creating age-friendly environments that support and encourage creative and active contributions, for example supporting the creation of digital content such as blogs or podcasts. Digital participation links closely to citizenship and the skills needed to take part in civic activities online, for example advocating for community matters or contributing to petitions. Recognising that the (non-)use of digital technology can be a conscious, individual and active choice (e.g., Waycott et al., 2016), not using digital technology should not be an obstacle to accessing basic services. Thus, maintaining conventional non-digital methods and services is vital to social inclusion.

Against this background, we pinpoint important enablers for digital participation in later life. An enabler is "something or someone that makes it possible for a particular thing to happen or be done" (Cambridge Dictionary, 2023). The purpose of this perspective article is not to generate a comprehensive overview of all enablers, but to expand current academic thinking beyond digital inclusion and literacy topics. The perspectives outlined here can contribute to prioritising digital participation in ageing policy and research agendas, as well as showcase opportunities for diverse, meaningful and fulfilling digital lives of older adults beyond the COVID-19 pandemic.

2. Macro-meso-micro level enablers to digital participation

We use the term 'enabler' broadly to describe a variety of individual, environmental, social, structural, and technological conditions that encourage digital participation in later life. The enablers outlined can be of international relevance, given digital exclusion and inequity in later life as common challenges across countries (e.g., in Europe see Esteban-Navarro et al., 2020; in the US see Yu et al., 2016; in Asia see Liu et al., 2021). Based on the enablers we identified, we propose a macro-meso-micro framework of partnership building, and further highlight the importance of mobilising and leveraging partnership resources, as well as utilising knowledge for action on different levels.

2.1. Macro level

Policy can shape most determinants of healthy ageing (World Health Organization, 2020), such as digital inclusion and equity. The focus of many policy and advocacy initiatives before and during the COVID-19 pandemic was on tackling digital exclusion and addressing digital disadvantages. Considering the continuous policy directions and improvements in enhancing digital inclusion, access and skills amongst older adults [e.g., for the progress made in Europe and North America, see United Nations Economic Commission for Europe (UNECE), 2022; for the progress made in Asia and the Pacific, see United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), 2022], more policy endeavours are needed to promote digital participation in later life. Existing digital policies should be reviewed and updated in consultations with older adults, their families, communities and other stakeholders in order to develop supportive policies for older adults to contribute to digitalised societies. This includes a stronger policy focus on digital participation skills beyond the existing digital inclusion policies. Given that multiple factors such as financial security and social support (Olsson et al., 2019) affect digital participation in later life (Hargittai et al., 2019), a participatory multisectoral approach is required to facilitate policy dialogue on the issues of digitalisation and ageing.

Creating a *positive culture* around older adults' use of digital technologies is vital to meaningful digital participation in later life.

Societal ageism has increased in many countries during the COVID-19 pandemic, reflected in prevalent notions of older adults as a "vulnerable group" (United Nations, 2020; Ayalon et al., 2021). Ageism manifests in social and cultural discourses of digital technology (Mannheim et al., 2022). Digital technology, such as artificial intelligence, can reproduce and generate new forms of ageism that affect digital participation and experience in later life (Rosales and Fernández-Ardèvol, 2020; Chu et al., 2022; World Health Organization, 2022). Ageism in digital technology can be self-directed, for example through negative self-perceptions and attitudes towards technology (Choi et al., 2020). Self-ageism is a barrier to technology adoption and engagement amongst older adults (Köttl et al., 2022). Ageism can lead to negative health and wellbeing outcomes and affect digital lives of older adults in households, communities and society. As indicated by a systematic review on digital inclusion programmes by Gates and Wilson-Menzfeld (2022), addressing ageist stereotypes, for example the perception of lower ability to engage with digital skills due to age, may avoid negative experiences in learning new digital skills and build confidence. It is important to consider individual needs and involve users across generations in the policies aiming to support digital participation (Fristedt et al., 2021). Tackling ageism can therefore contribute to a positive self or social awareness of ageing with digital technology and enable more older adults to become active, competent and confident digital citizens.

2.2. Meso level

Knowledge and skills in communities and civil society organisations are assets to digital participation and can potentially be leveraged in digital participation initiatives for older adults. Capacity building efforts are needed to increase digital knowledge and skills within digitally disadvantaged groups to sustain their digital participation. As an example of a digital participation initiative in Sweden, SeniorNet (a civil society organisation) set up study programmes to support advanced use of technology in later life. Moving from a user perspective towards a citizen perspective encourages positive changes older adults can generate in their living environments through the use of digital technologies. For older adults who are already online, digital communities can be further optimised to enhance wellbeing. Harley et al. (2014) proposed initiatives to improve digital participation, such as creating private "family rooms" and anonymous "sharing spaces" in online communities for older adults to connect online and local communities. In addition to utilising existing community resources, it is important to enhance community social capital and promote a participatory culture, thereby contributing to sustainability. As noted by Lu et al. (2022), community social capital can be enhanced with three approaches, namely promoting emotional meaningfulness, including older adults as co-producers of community activities, and cultivating an inclusive and equitable society. These approaches can be an inspiration in building up community capital and capacity for digital participation and therefore support active digital citizenship in later life.

Established community development programmes can be a window of opportunity to include digital participation initiatives. Age-friendly initiatives, such as the WHO's age-friendly cities and communities (AFCC), which aim to increase civic participation in later life, are yet to incorporate digital environments in their policy frameworks (Marston and van Hoof, 2019). As a response, Liddle et al. (2020) proposed integrating digital environments into conceptual understandings of digitally connected AFCCs, with sensitivity to local contexts. Moving from a digital inclusion approach towards a digital participatory approach has the potential to support older adults in executing their digital citizenship to its fullest. This encompasses, for example, increasing digital participatory skills that support older adults in advocating for topics that matter to them on the local level (Clarke et al., 2016) and support their engagement and leadership in policy-and decision-making processes and interventions.

Digitalised local organisations and services pose challenges and opportunities to digital participation in later life. Digital technology that is not age-inclusive can challenge older adults' use of digital services. In contrast, volunteering and other collective types of civic participation in later life can cultivate new digital participatory skills. In fact, extant research reveals positive correlations between digital competence and participation in civil society organisations (Olsson et al., 2019). Throughout the COVID-19 pandemic many community organisations shifted their engagement into digital spaces through virtual meetings. As this trend may continue and become part of the "new normal" in post-pandemic times, there is a need to support communities that (are willing to) address digital aspects of civic participation and boost creativity for new forms of digital and in-person engagement in later life. From a future-oriented perspective, older adults in increasingly digitalised and technology-mediated community spaces may dynamically choose to shift between different types of civic participation. Volunteering in its traditional sense is often focused on in-person interactions. Thus, digitalised volunteering, such as taking part in virtual neighbourhood meetings or volunteering to teach digital skills, offers opportunities for wider engagement beyond geographic boundaries or local issues. This in turn can tie into wider societal or political debates (Reuter, 2021).

2.3. Micro level

Technology-mediated interactions shape the process and experiences of digital participation and specifically equip older adults with the necessary skills to take on leading roles in digitalised civic activities (Trentham and Neysmith, 2018). Whilst on a micro-level the intergenerational family context plays an important role in the learning of digital skills (Martínez and Olsson, 2022), a long-term structure of support is vital to address diverse challenges that older individuals may face and improve their lived experiences and wellbeing (Manchester and Facer, 2015; Fischl et al., 2017, 2020), which may involve partner, children and grandchildren, close friends, and neighbours. Considering microenvironments of digital participation within and beyond the family context can also encompass peer-to-peer learning activities, in which older adults provide support to others in digital spaces (Hill et al., 2015). Addressing micro-level influencing factors of digital participation can help address older individuals' needs, preferences and concerns. This may facilitate active, positive and sustainable learning experiences across the life course, which support individuals to dynamically adapt to emerging technologies. Community digital learning programmes should be tailored to meet the needs, preferences and expectations of older individuals and their families. Creating prerequisites for the development of older adults' digital participatory skills and

competence in creating, evaluating and communicating participation can help create alternative images of older adults, thus challenging societal ageism.

3. A proposed partnership framework to connect multi-level enablers in the community

Building partnerships has long been recognised as an effective approach to promoting health and wellbeing on the community level (Israel et al., 2001). Digital participation in later life, however, has not been sufficiently addressed in its complexity of stakeholder engagement. The focus-to-date of multi-stakeholder partnership and action in promoting digital inclusion and participation in later life is often health-related. However, as argued above, this does not fairly reflect the heterogeneous digital lives of older adults. Given the diversity and complex impacts of digital technologies on later life, there is a need to advance our understanding of partnership for digital participation across different life domains, such as health, working life, leisure, or civic life. Based on the aforementioned micro, meso and macro enablers to digital participation, we propose a community-based partnership model that connects multi-level enablers. The ultimate goal is to optimise conditions and environments so that everyone has the opportunity to participate fully in digital activities in later life. We developed a visual guide for building partnerships towards this goal (Figure 1).

A possible direction towards partnership for digital participation could be initiating multi-stakeholder collaborations around promoting the purposeful use of digital technologies. Key stakeholders include older adults, their families and friends (micro level), private sector companies, academia, media, communities and civil society organisations (meso level). Examples of macro level stakeholders are national governments and authorities.

Specific partnership goals as outlined in Figure 1 might be to leverage existing knowledge, skills, and resources. This includes engaging community stakeholders, identifying financial and non-financial resources to initiate and sustain digital participation programmes, and connecting individual needs and preferences with existing resources. Another goal is to advance the creation of digital opportunities within AFCCs. This might include improving technology usability and accessibility, but also involve older adults and relevant stakeholders in technology design, use and deployment. Opportunities might also encompass the co-production and communication of age-friendly information, where older adults can digitally take part as consulting citizens and active contributors (Reuter et al., 2020a). One example is the use of audio-visual media by older adults in the community to advocate for age-friendliness in local planning (Clarke et al., 2016). Another example is the creation of radio shows to promote diverse voices of older adults in public debate (Later Life Audio and Radio Cooperative, 2022). In these example practices different generations, municipalities and local authorities, researchers and civil society organisations are relevant stakeholders.

Another direction is to expand social networks and enhance the integration of digital and non-digital services provided by

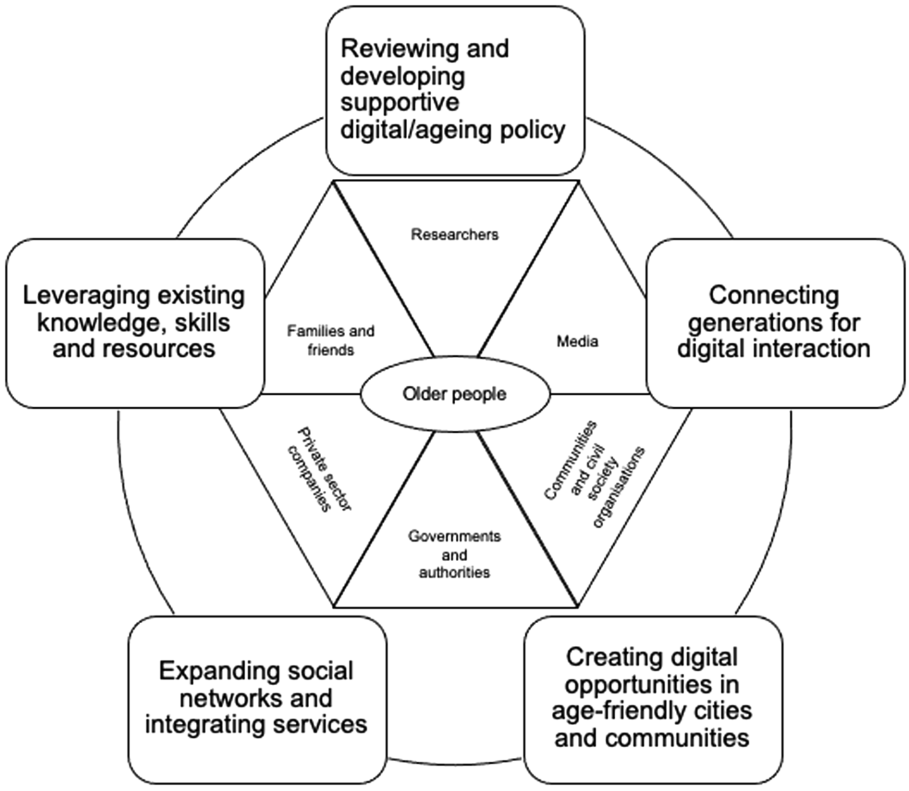

FIGURE 1
A visual guide to partnership building for digital participation in later life.

various sectors. It may take place in different forms, for example inspired by the concept of social prescription (Bertotti et al., 2018), which connects people with services. Taken further, a digital prescription approach could connect older adults beyond close contacts with multiple sectors and cover a wide range of digital services, integrated information and communication systems. To sustain these partnerships, it is important to address the sustainability of digital participation programmes for long-term impacts by reinforcing political commitment, securing funding and utilising existing resources. It is essential to amplify the innovative interventions with scale-up potential by customising approaches to unique circumstances and improving profitability. A second focus should be given to connecting generations for digital interaction as part of these partnerships. By taking on an intergenerational approach, understanding, learning and mutual respect can be promoted between generations and skills and opportunities identified.

Policymakers are advised to review and develop digital policy to ensure that issues of ageing are considered and addressed. Such efforts may incorporate later-life digital participation within policy agendas, reframing ageing and technology in policy discourse, and propose concrete measures for implementation. These efforts need to be informed by the best available evidence; it is vital to strengthen knowledge generation and translation into policy and practise. Conducting community-based or participatory action research (Corrado et al., 2020) may drive partnerships and changes for digital participation in later life. Utilising scientific expertise and knowledge traditionally held by academic institutions could support older individuals in developing digital skills in social settings (including intergenerational contexts) and benefit civic society at large. In academic endeavours, researchers play a positive and mediating role in improving later-life digital participation across levels, sectors and stakeholders. Indeed, researchers and older adults in communities could jointly induce positive changes in digital community lives.

4. Call to action

We call to create, develop and sustain partnership in project-based participation initiatives alongside structured or institutionalised learning schemes, with the vision of a digital society where older adults can fully participate and enhance their creative power. Such initiatives should consider online-offline hybrid participation to be inclusive and ensure that older adults' preferences and desires are considered and achieved to the fullest extent possible. In this way, older adults will be able to engage in the partnership approach and have opportunities to enhance their digitalised participation, if they so wish. Both digital inclusion and participation approaches to improve the lives of older adults should co-exist. Specifically, digital learning opportunities should be scaled up and implemented in communities to ensure basic levels of digital inclusion and literacy. Additionally, active citizen participation in later life as well as solidarity across generations and communities should be strengthened by creating more project-or programme-based participation opportunities. Taking multi-level enablers of digital participation in later life into account, we call for multi-layered and multisectoral partnerships that optimise conditions and environments for older people's diverse, meaningful and fulfilling engagement with ICTs.

To further implement this partnership approach, we suggest first, that communities ensure digital inclusion for all ages, promote digital participation in later life, and integrate digital participation into community development agendas. Second, multi-sectoral and stakeholder collaboration for digital participation should be strengthened within and across communities. The digital sector, especially the digital public sector (e.g., e-Government using technology to provide services to citizens), can shape digital participation in later life by raising awareness for the issue in their collaborations with other sectors. Third, we emphasise the importance of community champions in mediating communications across different levels for partnership-building. Any relevant stakeholders can take the lead on and contribute to building partnerships. Last but not least, older people should be considered as both citizens and partners in optimising environments for digital participation.

This article was written by researchers based in Sweden, which is the country with the highest levels of digitalisation in Europe. Future studies are needed to evaluate the scalability and key areas of the proposed framework and provide insight into its application in different national contexts.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

AR and WX: conceptualisation and writing—original draft preparation. SI, TO, and SS: review and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Encouraging prosocial behavior from older adults through robot teleoperation: A feasibility study

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Introduction: In Japan, the social climate surrounding older adults has gotten worse as a result of the spread of COVID-19 and the growing isolation of older adults who are increasingly unable to engage in prosocial behavior through work and volunteering. This is detrimental to the physical and mental well-being of older adults. The purpose of this study is to look into robot teleoperation for older adults as a viable way to deal with these issues and overcome the barriers preventing older adults from engaging in prosocial behavior.

Materials and methods: We designed and tested a remote-control approach for dialogue agents that is appropriate for older adults as well as evaluating their impressions in a real-world setting. Twelve older adults participated in experiments in two separate locations, a children's center and the city ward office, where they could remotely teleoperate a robot and have conversations with the visitors. In the city ward office, the older adults had a conversation with the visitors and gave them information and trivia quizzes about the city. In the children's center, older adults had conversations with children regarding their age, family, their likes, and dislikes. A questionnaire and interview were set up after the experiments to understand their impressions of the system and to clarify how older adults feel about certain issues regarding remote-controlled work, starting a new job, social interaction, to what extent have older adults been affected by the pandemic, how and in what ways has it affected their involvement in society, and whether teleoperating a robot can be a suitable approach to encourage prosocial behavior from them through volunteer work and social engagement.

Results: The results show that older adults have a strong desire to engage in volunteer work, but are hampered mainly by physical isolation resulting from COVID-19 restrictions and their declining physical and mental health. Their impressions of the teleoperation system were highly positive, as they enjoyed having conversations with children through the robot. With this teleoperation system, older adults were able to remote control a robot by themselves without major issues. It made interaction simpler as conversing with children through a robot added a layer of anonymity that allowed older adults to express themselves freely without worrying about how they are perceived by others in public.

Discussion: Older adults were able to successfully engage in prosocial behavior through remote-controlling a robot. The system seems to be effective at easing the physical barriers preventing older adults from engaging in volunteer work, which have worsened since the spread of COVID-19.

KEYWORDS

older adults, teleoperation, prosocial behavior, remote control, interactive agent

1. Introduction

As of 2020, in particular, the social environment surrounding older adults has deteriorated due to the spread of COVID-19 as more and more adults become more isolated (Sayin Kasar and Karaman, 2021), given that many older adults live alone or only with their partners (United Nations, 2017). Other factors such as physical isolation, lack

of transportation, and health declines can limit the older adults' ability to travel and commute and thus can amplify their isolation (Cotton et al., 2012; Winstead et al., 2013). This isolation is also dangerous for older adults as isolation and loneliness have been shown to be heavily linked with the onset of dementia (Holwerda et al., 2012). Additionally, isolation also limits their involvement in prosocial behavior through volunteer work and engagement with their community, which is essential for their wellbeing.

Prosocial behavior, which includes offering support, cooperation, consolation, sharing, volunteering, and making donations (Greener and Crick, 1999; Eisenberg et al., 2007), is described as an activity that benefits others (Eisenberg et al., 2015). For the "helper," this behavior can have a variety of positive benefits, such as mood-boosting effects, where the helper is more likely to feel good after helping and experiences bad mood less frequently overall (Raposa et al., 2016). Research has demonstrated that social support can have a favorable impact on wellness, including lowering the likelihood of loneliness, alcohol use, and depression (American Psychological Association, 2019). Another advantage is the ability to reduce stress. Prosocial activity can help lessen the negative emotional impacts of stress, and helping others can be a fantastic way to lessen stress in one's own life (Raposa et al., 2016).

We can therefore see that prosocial behavior is crucial for older adults for fostering social integration and maintaining healthy social interactions. Social relationships are extremely helpful, as keeping the mind active through conversation helps in limiting the onset of dementia (Fratiglioni et al., 2000) and has also been shown to reduce loneliness (Perese and Wolf, 2005). The benefits of playing a productive role in society to one's physical and mental health have been thoroughly proven (Luoh and Herzog, 2002; Musick and Wilson, 2003). Older adults may experience social retreat and a loss of identity and purpose after retirement, which can be harmful to their physical, psychological, and social wellbeing (Moen et al., 2000). After retirement, engaging in productive activities, whether paid or unpaid, has been demonstrated to protect against these consequences (Luoh and Herzog, 2002), with stronger benefits in volunteer work by older persons (Li and Ferraro, 2006). Volunteer work in the form of intergenerational programs has been introduced by local Japanese governments where older adults support children in local schools in an effort to fight social isolation (Murayama et al., 2015). Intergenerational programs have been shown in prior research to positively impact a number of outcomes. Improved physical and mental health, as well as more social interaction, benefit older persons (Hong and Morrow-Howell, 2010; Murayama et al., 2015; Sakurai et al., 2016). These programs will help students' academic achievement, attitudes toward volunteering in the community, and perceptions of the elderly (Murayama et al., 2012; Yasunaga et al., 2016).

2. Related work

According to the studies done by Cotton et al. (2012) and Winstead et al. (2013), older adults can use communication technology to overcome social and spatial limitations. Winstead et al. (2013) describe qualitative studies in which older adults in assisted living communities used technology such as Google Maps with Street View and virtual tours of cultural institutions to stay connected to places of sentimental value or to "visit" places of interest that were no longer accessible to them. Loneliness and social isolation were reduced as a result of these internet visits.

The current spread of coronavirus is expected to subside with the roll-out of vaccination, but new variants are constantly appearing and new viruses may emerge in the future. On the other hand, remote work has grown rapidly during the coronavirus pandemic (Brynjolfsson et al., 2020), however, there is speculation about whether older adults can cope with this change and whether they can participate in society remotely. Kostoska et al. (2015) wanted to answer this question of whether older adults can participate in society by virtual participation of a museum visit, where they found that older adults were able to understand the presented museum content and were perfectly able to follow the virtual tour.

But joining online museum tours might not be enough, as older adults might be more inclined to take an active role in their community. It is expected that older adults are highly motivated to engage in society but within some temporal and spatial limitations. For example, a majority of older adults want to work (paid or non-paid) but in fairly short intervals of time and at a location that is close to their homes (Ministry of Health Labor and Welfare, 2015). Another limitation is that many of them want to perform tasks that are similar to what they did before they retired or use their existing knowledge and experience (Ministry of Health Labor and Welfare, 2015). However, these limitations, coupled with their physical isolation, make it very difficult for older adults to find such work. Ibarra et al. (2016) reviewed online tools (paid and non-paid) that enable social contributions by older adults. The tools included general-purpose volunteering services and crowd-sourcing services. They found that very few remote online contribution sites specifically target the adult population with very low support. They found that older adults want to help others by making a difference in causes they care about where helping others is the motivating factor; however, few of their reviewed online tools are expressly developed for older adults, both in terms of technology and online work.

Therefore, it seems that older adults are motivated to perform prosocial behavior through volunteering within limitations and there are very few options targeted specifically for older adults. One possible solution to this problem is through performing tasks by teleoperation of a robot. By operating a robot from a remote location, we can solve problems regarding time and distance. Short and long distances between work locations would not be an obstacle anymore, also making it possible for older adults to work only for short periods of time.

Teleoperation, in general, means performing some kind of work from a distance, although "work" can be almost anything. Teleoperation is a robot technology in which a human operator (master) commands a robot from a distance (slave). The teleoperator, a slave robot at a remote site, and the control module make up the system. Teleoperation has traditionally been utilized in instances where typical on-board manual operation/control is not possible or would be too dangerous or costly. Handling nuclear materials (dangerous), controlling small models (difficult), and space and undersea exploration (too hazardous and expensive) are all examples.

Modern teleoperation started when the first master-slave manipulator for chemical and nuclear material handling was created in the Argonne National Laboratory toward the end

of the 1940s (Goertz, 1949). Following it, the advancement of teleoperation was rapid. The earliest telepresence systems were made possible by adapting visual technology and force feedback to teleoperation. Computer technology enabled elaborate control loops to be implemented at the remote (teleoperator) end of the system, and virtual reality was ultimately introduced to teleoperation (Taylor et al., 1993). Teleoperation has been utilized in so many fields as was previously mentioned, but we will only consider specifically Telepresence robots in the context of telepresence applications where the presence of a human is replaced with a robot that is remotely operated by another human.

A typical example of telepresence applications is teleconference such as the PEBBLES teleconferencing robot (Yeung and Fels, 2005) from Telbotics, which is a telepresence system that uses a remotely controlled robot to allow elementary school children who are unable to attend school due to illness or other reasons to establish a presence in their classroom. Other applications of telepresence robots include nursing and healthcare applications. This is especially important in Japan where the population is getting older, thus there is a bigger need for nurses and healthcare professionals. Teleoperated robots, in this case, can provide a way for patients to get in contact with a nurse. A nurse will be able to operate several robots and attend to multiple patients simultaneously.

In this study, we developed a prototype of a robot teleoperation system that can be easily operated by older adults and conducted experiments in a real environment to evaluate their impressions of the system, including whether older adults can accept it. A questionnaire and interview were set up to clarify how older adults feel about certain issues regarding remote-controlled work, starting a new job, and social interaction in general. We want to understand to what extent have older adults been affected by the pandemic, how and in what ways has it affected their involvement in society, and whether teleoperating a robot can be a suitable approach to encourage prosocial behavior from them through volunteer work and social engagement. We hypothesize that older adults want to have a sense of purpose and want to engage in prosocial behavior mainly through participating in society by volunteering in social work even though it has become more challenging due to physical, social, and health constraints. And if they do want to engage in such activities, can we provide them with the means to perform such activities that can overcome the previously mentioned barriers? In this paper, we report the initial results.

3. Materials and methods

3.1. Robot teleoperation

3.1.1. Robot used

The robot used was a small interactive robot "RoBoHoN" manufactured by Sharp Corporation (Sharp Corporation, 2021). RoBoHoN is a small child-like robot with a height of 19.5 cm and a mass of about 360 g. The robot used is shown in Figure 1. RoBoHoN uses a Qualcomm Snapdragon 430 processor (8x ARM Cortex A53), 16 GB ROM/16 GB RAM. The robot includes a speaker, an 8-megapixel camera, a three-axis accelerometer, a three-axis magnetometer, a three-axis gyroscope, Bluetooth, Wi-Fi, and GPS, as well as a microphone array with two microphones that allows for an approximate estimation of horizontal sound source direction. LED lights are also placed on its mouth and eyes. A touch screen is also mounted on the robot's back. It also has built-in motors in its neck and arms and can perform gestures and speech synthesis. In this study, with the cooperation of Sharp Corporation, we modified the firmware to enable voice recording and servo motor control, and introduced an application for remote control, which will be described in the next subsection, and used for the experiments.

FIGURE 1
The figure shows RoBoHoN by Sharp Corporation (2021).

3.1.2. Remote control

The teleoperation system was developed using WebRTC. On the operator side, we developed an interface that runs on a Web browser, and on the robot side, we developed an application using a native library and connected it using an existing signaling and TURN server. Media streams are used for video and audio transmission, and data streams are used for robot control and status acquisition.

The robot's speech can be generated in four different ways:

1. Direct transmission of the operator's voice.
2. Text-to-speech speech with text input.
3. Text-to-speech where specific pre-defined set phrases can be pressed on the screen.
4. Speech recognition and speech re-synthesis.

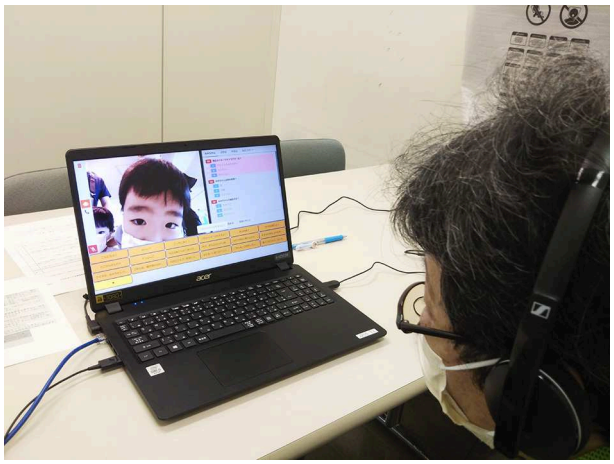

FIGURE 2
The teleoperation interface.

FIGURE 3
The teleoperation setup in the children's center.

For cases 2, 3, and 4, the same robotic voice is used regardless of the operator, as RoBoHoN's own built-in speech synthesis mechanism is used. For case 1, a voice changer can be used, but the voice output will be different for each operator as it is a direct transmission of the operator's voice.

Figure 2 shows an example of a remote control interface. The upper left corner of the screen shows the image captured by the robot's onboard camera. By looking at this screen, the operator can recognize that there is a person in front of the robot and can clearly see him. In this area, when you move the mouse over to the left, center, and right sides of the screen, buttons are displayed to rotate the robot's neck angle to −45° (facing left), 0° (facing front), and 45° (facing right). The camera angle can be adjusted by clicking each button. When the mouse is moved over to the upper right corner, a button for disconnection appears, which can be clicked to end the remote control. On the left side of the screen, there is a button to cancel the speech, a button to switch between the robot's voice and the operator's voice by voice recognition, and a mute button. On the right side of the screen is an area where pre-determined speech content is placed according to the specifics of the experiment. In this experiment, we conducted a quiz and a guide to the facilities of the experiment location, so the text boxes were configured accordingly.

3.2. Experiment

3.2.1. Experimental procedure

Two separate experiments were conducted, each at a separate location, with the cooperation of Sakai City, Osaka Prefecture. A total of twelve older adults participated in the experiments. Five older adults participated in the first experiment which was at Sakai City Ward Office, and seven older adults participated in the second experiment which was at a large children's center. In both experiments, older adults interacted with the robot by remote control as shown in Figure 3. The experiments were conducted with the approval of the "Ethics Committee for Research Involving Human Subjects at the Graduate School of Engineering Science, Osaka University" (Approval No. R2-32-2). Written consent was obtained from the older adults who were to serve as the operators, and visitors to the facilities were given an explanation of the experiment, and consent was obtained by an opt-out method. The details of the experiment at each facility are described below.

In the experiment at the ward office, the robot was operated for a total of 1 h and 30 min per day over 3 days. Five older adults took turns operating the robot over the 3 days. The robot was set up on the first floor of the ward office, where pamphlets and other materials were placed. Two activities were included in this experiment, a conversation and a trivia quiz. These two activities were the same across the three days of the experiment. The robot was used to call out to visitors (e.g., by saying "Hello") to arouse their interest and encourage dialogue. When visitors came in front of the robot, the robot was remotely controlled by the older adults from a separate location in the facility. The visitors chatted with RoBoHoN and were given a quiz to teach them about their district. The older adults often asked visitors about their age, family, and what they liked and disliked, and they responded appropriately to visitors' responses and questions. In order to make it easier to hear the other person's voice and to make the robot's voice louder, a speaker with a microphone was placed near the robot and connected *via* Bluetooth. The quiz about the South District included questions in four categories with five questions in each category for a total of 20 questions. The categories were, "District mascot," "Sue Pottery," "District specialty produce," and "District famous spots." The quiz was mainly aimed at children although some of the visitors who participated were adults. When visitors give a wrong answer, the RoBoHoN operator would give them the right answer with more information. Some of the questions asked to visitors in the quiz:

- Who is the mascot of the South District?

  a. Sakaeru & Misosakai
  b. Mimi-chan

  Answer: The correct answer is Mimi-chan.
  Information: Mimi-chan, the mascot of South district, is the source of everyone's smiles!

- What is the name of the Kofun period earthenware produced in the South District?

  a. Sue pottery
  b. Haji pottery

  Answer: The correct answer is Sue pottery.
  Information: Sue pottery is characterized by being fired in a kiln, and it is said that it turns gray because the pores are sealed in the end!
- What is the characteristic color of Sue ware?

  a. Gray
  b. Reddish brown

  Answer: The correct answer is Gray.
  Information: Sue Pottery is the root of Arita pottery and Bizen pottery, famous Japanese pottery!
- What is the name of the produce stand at Harvest Hill?

  a. Matakitena
  b. Asukate kuru De

  Answer: The correct answer is Matakitena.
  Information: Sakai grown agricultural products "Sakai-no-megumi" are sold at "Matakitena"
- What are the annual rice planting and harvesting events held in the South District?

  a. Nogyo juku
  b. Tanbo ni GO! Hata ni GO!

  Answer: The correct answer is Tanbo ni GO! Hata ni GO!
  Information: This year we changed to a stay home plan and implemented it!
- Which park is located in the South District, famous for its beautiful rows of meta sequoia trees?

  a. Shinhinoo Park
  b. Ohasu Park

  Answer: The correct answer is Shinhinoo Park
  Information: Shinhinoo Park is also a cherry blossom viewing spot with 900 cherry trees planted there!

The second experiment was conducted at the children's center for 2 days. On the first day, the robot was set up in a corridor on the second floor of the facility, and two older adults took turns operating the robot for a total of 1 h and 30 min (with a break of 30 min for every 30 min). On the second day, the robot was set up in the exhibition room on the fourth floor of the facility, and the robot was operated for a total of 3 h. In the morning, it was operated by two older adults for 1 h and 30 min (with a 15 min break for each 30 min period). In the afternoon, it was operated by three older adults taking turns for another hour and 30 min. Since it was a children's center and during the long vacations, there were many visitors, so we did not make any special calls to visitors. In this experiment, a conversation was the only activity included. The older adults had a conversation with the children regarding their age, family, their likes and dislikes, and why they came to the facility.

3.2.2. Questionnaire and interview

A questionnaire and an interview were conducted with each operator after the experiment. The items in the questionnaire were asked again in the interview to allow the participants to elaborate more on their answers. Therefore, the questions in the interview include the items in the questionnaire and items specific to the interview.

The items of the questionnaire and interview are written in bold below, while the intent of the questions is shown right below it. It will be specified next to the item in parentheses whether the question was asked in the interview only or both the interview and the questionnaire.

Q1—Do you currently have a job? (interview)
Q2—Do you want to work? (interview)
With these questions, We wish to investigate the demand for remote-controlled robot work to see if there were any older adults who wanted to work, and in what conditions and restrictions would they be interested in working.

Q3—Do you have any concerns regarding COVID-19? (interview)
Q4—Has COVID-19 changed your lifestyle? (interview)
With these questions, We wish to understand how older adults have been affected by COVID-19 and whether this has created a barrier to their engagement in society. This also helps us verify the need for remote control work as a result of social circumstances.

Q5—Do you get any opportunities to interact with children?(interview and questionnaire)
Q6—Do you like children? (interview and questionnaire)
Q7—Do you want to interact with children? (interview)
Q8—Do you have any concerns about interacting with children? (interview)
With these questions, We wish to understand how older adults usually think about interacting with children and how they thought about them as a result of the experiment by interacting with children through a robot. The purpose is to verify whether interacting with children through a robot would ease communication difficulties between these two age groups.

Q9—What are you worried about when you start a new job? (interview and questionnaire)
Q10—What do you feel you can no longer do as you get older? (interview)
Q11—Did you have any worries before participating in this volunteer project? (interview)
With these questions, We wish to identify whether there are any barriers (health-related or otherwise) that might prevent older adults from working or volunteering.

Q12—How did you feel when you operated the robot? (interview and questionnaire)
Q13—What is the best thing about interacting with a robot by remote control? (interview)
Q14—What was not good about the robot's remote control interaction? (interview)
Q15—Do you want to participate again? (interview and questionnaire)
With these questions, We wish to understand how older adults felt about interacting with the robot by remote control, the positives and the negatives, in addition to their general impression of the system and their experience with it.

Q16—Please tell us about any difficulties you had with the controls or shortcomings you had with the robot. (interview and questionnaire)
Q17—Are there any parts that you find difficult to operate? (interview and questionnaire)
In order to create an interface that is easy to operate for older adults who are not proficient in operating the system; with these questions we wish to identify necessary improvements to the interface.

3.2.3. Participants

In total, 12 older adults participated in the two experiments. There were no dropouts. Seven participants were male and five participants were female. The average age of the participants was 74 years old (We only obtained age data for seven of the participants). Given that both experiments were conducted in Sakai city, ten of the participants actually did reside in Sakai city. One participant lived in Osaka city, and another participant lived in Sayama city, which are both close to Sakai city.

For the experiment in the Sakai City ward office, the recruitment process happened through mediation, where the staff of the ward office contacted the president of the residents' association in the southern district. The president then worked on recruiting participants for the experiment. For the experiment in the children's center, the staff of the Sakai City ward office contacted the director of the children's center, and the director recruited participants from the facility's registered volunteers.

All participants had no previous experience with a robot. When we inquired about their experience with smartphones, ten participants claimed to use smartphones on a daily basis while two participants said they only use smartphones sometimes. Regarding their experiences with computers, six participants said they use a computer on a daily basis, while four participants use a computer sometimes, and only two participants stated that they rarely use a computer.

4. Results

The results of the questionnaires and interviews of the 12 older adults are summarized below. The items of the questionnaire and interview are written in bold below, while the summary of the answers of the participants is shown right below it.

Q1—Do you currently have a job?
Eleven participants stated that they do not currently hold a job, although two of them said that they do volunteer work. Only one participant stated that he currently work.

Q2—Do you want to work?
Two participants stated that they have no interest in working at all, While the rest of the participants showed an interest in working as volunteers. The predominant mindset of most of the participants seemed to be an aversion to full-time (9 to 5) kind of jobs and more of an inclination to a less time restraining form of volunteer work where they can serve the community. One participant said, "As long as I am healthy, I would like to work to help others." In addition to just volunteer work, some participants wanted to work in a way that utilizes their hobbies and interests.

Q3—Do you have any concerns regarding COVID-19?
Seven participants said they do have concerns regarding COVID-19, while five participants stated they do not have any concerns. The participants who said they have no concerns explained that the reason for that is they have been heavily taking precautions.

Q4—Has COVID-19 changed your lifestyle?
All 12 participants stated that their lifestyle has changed because of COVID-19. The predominant answers are mainly a reluctance to leave the house, avoiding public transportation, only going out for groceries or emergencies, and basically cutting out outdoor activities and hobbies.

Q5—Do you get any opportunities to interact with children?
Two participants said they hardly ever get any opportunities, while ten participants said that they do get regular opportunities to interact with children through their volunteer work, or children in their family or neighborhood.

Q6—Do you like children?
Nine participants said that they like children, while three participants said they are not sure, thus seemingly reluctant to say that they are not that enthusiastic about children.

Q7—Do you want to interact with children?
All participants said that they do want to interact with children, however, two of the participants didn't seem particularly enthusiastic and said that it ultimately depends on how the interaction might be.

Q8—Do you have any concerns about interacting with children?
Eight participants said that they have no concerns about interacting with children while four participants stated that they have some concerns depending on the child's age and personality. They were quite worried about how noisy and active children might be, or that the child might run off to some strange place and that might be too much for them to handle.

Q9—What are you worried about when you start a new job?
Two participants mentioned that they have no concerns when starting a new job, while eight participants had concerns summarized as follows:

- Anxiety about starting new things.
- Jobs that require more knowledge than what they already have.
- Jobs where they have to assume responsibility.
- Tasks that make them feel insecure.
- Their deteriorating memory because of their age.
- Whether they can keep up because of their age.
- Whether they can keep up with the changing societal structure and technology.
- Whether others can accept the way they think.

Q10—What do you feel you can no longer do as you get older?
One participant said that they can't think of anything in particular that they can no longer do because of their age. The answers of the other nine participants are summarized as follows:

- A decline in physical fitness.
- Deterioration of their eyesight.
- A decline in motor skills.
- A decline in memory.
- A decline in concentration.
- A decline in strength.
- A decline in muscle power.
- They get easily bored when doing something.

Q11—Did you have any worries before participating in this volunteer project?
Nine participants said that they were not particularly worried, the others said they had some worries but they thought they could do the task if it was properly explained to them and if it was something new and interesting. Two participants were worried, though their worries were mainly about causing fatal damage to the computer by mishandling it.

Q12—How did you feel when you operated the robot?
Seven participants said that operating the robot was fun, four participants said that it was interesting, while one participant said they felt nothing in particular. Most participants who found it fun mentioned that they mostly enjoyed talking to another human through a robot and specifically being able to speak with the robot's voice instead of their own, one participant even said, "it felt as if I was transformed."

Q13—What is the best thing about interacting with a robot by remote control?
The answers of all participants are summarized as follows:

- The fact that the other person was interested in the robot and could talk to it.
- The fact that I could talk to a child for the first time in a while.
- The fact that I could talk in the robot's voice.
- The fact that I could talk to a child from the perspective and voice of a robot.
- The fact that the hurdle of talking to a child is minimized.

Q14—What was not good about the robot's remote control interaction?
The answers of all participants are summarized as follows:

- It was difficult to speak as a "child" as per the robot's age setting.
- The other person cannot perceive the robot's emotions.
- It was somehow not good to interact in a non-face-to-face manner.
- It was difficult to understand the other person's voice and reactions.
- I cannot hear what I said so it was difficult to know if the robot actually repeated what I said.

Q15—Do you want to participate again?
One participant said "maybe" because it was too much trouble to leave the house. Eleven participants said that they would like to participate again as they enjoyed speaking through the robot, and they want to operate the robot in a better way next time and want to see improvements in the system. One of these 11 participants said that he is interested in participating again as it might help slow down the aging of his brain.

Q16—Please tell us about any difficulties you had with the controls or shortcomings you had with the robot.
The problems that the participants mentioned are as follows:

- The time lag caused by voice recognition makes the system difficult to use.
- Confusing button layout. It is difficult to locate the buttons.
- It would be better if the robot could move its head vertically.

Q17—Are there any parts that you find difficult to operate? The problems that the participants mentioned are as follows:

- they were not able to understand what the robot was saying and the timing of the speech.
- they were not able to deal with problems by themselves.
- they were not used to using a mouse.
- there was a time lag due to communication speed or voice recognition.
- they were not used to using a computer.
- it was difficult to understand the position of the buttons.
- it was difficult to hear the other person's voice.

5. Discussion

From the results of **Q1** and **Q2** of the questionnaire, a majority of the people mentioned that they do not currently work and would like to work but as a volunteer. This shows their readiness to engage in prosocial behavior through volunteering as they are less interested in a full-time job. Their interest lies mainly in helping others and serving the community. This confirms our hypothesis that older adults do want to engage in society mainly through volunteer work but within short time periods (Ministry of Health Labor and Welfare, 2015).

We suspect that older adults want to engage in volunteer work but are limited by a number of factors such as the spread of COVID-19 and declines in physical and mental health. There might be other factors involved such as anxiety relating to starting a job or volunteering in something new that is far from their previous area of expertise and knowledge.

From **Q3** and **Q4**, all participants mentioned that their lifestyles changed due to COVID-19 and seven of them mentioned that they do have concerns regarding the pandemic. Most participants are interested in engaging in volunteer work but are physically unable to due to their changed lifestyles as a result of the spread of the coronavirus. This shows that there is a need for participating in society remotely and it confirms the limitation that older adults are interested in engaging in society but are restricted by spatial limitations (Ministry of Health Labor and Welfare, 2015).

With **Q9** we were trying to identify what factors might be causing concern or anxiety for older adults when beginning a new job (or volunteer work). This might be helpful in better designing our system to overcome some of their concerns. From the participants' responses, older adults seem to be rather anxious about engaging in activities that they are not used to doing. They feel the decline in their physical and mental abilities as well as their lack of knowledge of the new activity is a limiting factor. Having a system that can support their work is therefore essential in overcoming such barriers. In the first experiment at the ward office, the quiz that was conducted by older adults was provided as text boxes on the side of the screen. This is helpful in overcoming obstacles related to their deteriorating memory, age, and lack of knowledge in certain areas.

From **Q10**, we were trying to understand how older adults feel they have been physically and mentally affected as they get older. Their responses varied from a decline in physical abilities (physical fitness, eyesight, motor skills, strength) to a decline in mental abilities (memory, concentration). The decline In their physical abilities is a great hindrance to their ability to commute and be physically present to engage in volunteer work, and the decline in mental abilities is also a hindrance to the type of volunteer work they are able to engage in. Using a robot teleoperation system, we hope it helps to overcome the physical factors (by teleoperating from a distance) and mental factors (by giving on screen support and knowledge) preventing older adults from engaging in volunteer work.

As for the remote control, from **Q11** most participants stated that they were not initially worried and thought they can do it if the process is properly explained to them and that it seemed like something new and interesting even if it was difficult. Two participants stated that they were actually worried but thought they could manage as their biggest concern was causing damage to the equipment. This suggests that even though older adults might show slight concerns, they are not averse to trying something new if it is well explained to them and the system was easy to use to some extent.

5.1. Encouraging prosocial behavior

In the experiments at the ward office and the children's center, older adults engaged in prosocial behavior by interacting with children. From **Q5**, **Q6**, **Q7**, and **Q8**, most participants were looking forward to engaging with children. The older adults wanted to help children in the ward office by introducing and explaining to them the district's famous sites, products, and historical artifacts. In the experiments at the children's center, they wanted to help children by providing them entertainment and giving them advice, and even helping their parents. One of the older adults stated the following, "With young children, I think it is worthwhile to help them in various ways and teach them various things." Another older adult said, "I love seeing children have fun, and I also want to help their parents raise their children a little." The older adults received satisfaction from these interactions mainly through feeling the enjoyment of the children and their interest in the robot, or even just through the opportunity of talking to a child. Just as was shown by Raposa et al. (2016), the "helper" engaged in prosocial behavior will experience positive benefits such as feeling good after helping. One of the older adults said, "It was great to feel the children's interest in the robot, and their various reactions to what I said." The participant here felt joy purely through observing the children's reactions to the robot. The use of a robot here as a medium has eased communication between two different groups of people that might usually have a hard time communicating. As children found communicating with a robot fairly interesting and enjoyable, older adults were glad to be the cause of that joy. Another older adult said, "I don't have any grandchildren, but I think that children, no matter who they are, are very dear to me. That's why in this experiment, I felt glad to talk to a child for the first time in a long time." The older adult here has been lacking the opportunity to talk to children due to physical isolation even though he much enjoys it.

By teleoperating a robot, he can overcome that obstacle and engage with children remotely.

In the experiment at the ward office, from the point of view of the "receiver," the children and adult visitors were able to get helpful information and gain knowledge about their city and received guidance on some important historical sites and social events. The other "receiver" is the ward office, which might see an increased number of visitors that would like to interact with the robot, and reduce the workload of the staff that can handle other inquiries from the visitors. In the experiment at the children's center, the "receiver," the children and their parents, visited the center to spend an entertaining day as a family. The children and parents seemed to gain benefit from their interaction with RoBoHoN by being able to experience new technology and by having an enjoyable conversational experience with a robot. Another "receiver" is the children's center which can offer visitors the opportunity to interact with a robot, which might increase its number of visitors because of the availability of such a unique experience for families.

Therefore, older adults were able to successfully engage in prosocial behavior by participating in society through volunteer work. By teleoperating a robot, they were able to overcome spatial and temporal barriers that might otherwise prevent them from engaging in such behavior.

5.2. System impressions

Participants, in general, had favorable impressions of the teleoperation. From **Q15** when asked if they would like to participate in the experiment again, 11 participants answered that they would like to participate. Older adults seemed to enjoy engaging with other people through the teleoperation of a robot. From **Q12** and **Q13**, the positives of teleoperation with a robot were mainly making interaction much easier by pretending to be a robot like a masked effect due to the operator's anonymity with respect to the target. Thus, the hurdle of talking to a child was lowered according to the participants. From **Q8**, some older adults had some concerns about interacting with children mainly due to their inability to control a child's behavior, the older adult's engagement through remote teleoperation makes it simpler to engage with children as it limits their involvement to only dialogue rather than worrying about how the child might behave in their presence. This also eliminated the embarrassment that some participants might feel when talking to a child in public as they can be self-conscious about how they might be perceived by others around them. Additionally, children might be more interested in speaking to a robot than speaking to an older adult face-to-face. this eases communication between older adults who are very interested in conversing with children and children who might be more interested in conversing with a robot.

The participants also stated they liked that they could talk through the robot from the perspective and voice of a child robot. One of the older adults stated, "I felt as if I was transformed, and I could experience the feeling of being in contact with the children." This effect is termed the Proteus effect (Yee and Bailenson, 2007), where an operator conforms to the behavior that they believe others would expect of them. In other words, the operator (in this case, older adults) behave as a child robot as they believe that this is the behavior that the perceiver (in this case, children) is expecting from the child robot. On the other hand, this also might have been an effect of behavioral confirmation (Snyder et al., 1977), whereby the expectations of the perceiver cause the operator to behave in ways that confirm the perceiver's expectations. In other words, the perceivers (in this case, children) are talking to a child robot fully expecting its behavior and conversational ability to be that of a child robot. This expectation causes the operator (in this case, older adults) who are in complete anonymity to act as a child-like robot (confirming the expectations of the perceiver). In this case, speaking like a child as they believe they are being perceived as a child-like robot as opposed to an adult. It is crucial to note here that the change in behavior from behavioral confirmation originates from the perceiver rather than the operator. It is thus, the perceiver's behavior that causes the operator to change his behavior, unlike the Proteus effect, where the operator changes his behavior regardless of the perceiver's behavior. In this experiment, the change in behavior of older adults to match that of a child-like robot might have been a combination of both the Proteus effect and behavioral confirmation.

Aside from these mentioned positives, there were some negative aspects pointed out by the participants. From **Q16** and **Q17**, four people stated that the time lag caused by voice recognition created difficulty in operation. When speaking using the robot's speech recognition and re-synthesis, the operator's voice input is converted into character strings using speech recognition, and then synthesized to audio with RoBoHoN's built-in speech synthesis mechanism. This slow process caused a lag as opposed to the direct transmission of the operator's voice which would not require any speech recognition or re-synthesis. When participants learned about the various functions available for speech, they opted for the former as they felt it would be weird and embarrassing to hear their own voice come out of the robot. The time lag caused by the voice recognition also created a difficulty in communication with children, as children are typically impatient and have a short attention span. With a longer interaction time, this can cause the children to get easily bored.

Participants also stated that they were not able to understand what the robot was saying and could not perceive the timing of their speech. The reason for this was the use of a Bluetooth speaker and microphone for RoBoHoN's speech. This speaker has a higher volume output and a better microphone sensitivity compared to RoBoHoN's onboard hardware. The idea was to make it easier for visitors to hear RoBoHoN's speech and to more clearly hear the visitors. However, the microphone speaker has an echo cancelation function that prevented the operator from hearing the audio output from the RoBoHoN. With these experiment conditions, it was very difficult for the operators to hear what they spoke, and were unable to understand the timing of their own speech. Therefore in the second experiment, the Bluetooth microphone speaker was removed and the standard RoBoHoN microphone and speaker were used. With these changes, some visitors commented that it was difficult to hear the robot's voice. RoBoHoN's built-in microphone is sufficient for autonomous conversation, as it is only required to recognize a certain number of keywords in speech, however,

its performance is not good enough to be used as a device for dialogue. For this reason, a microphone device with high sensitivity and no echo-cancelation function would be preferential. From **Q16** regarding the operator screen layout, one of the participants mentioned that it was difficult to locate the positions of the various buttons for operation. Therefore, it is important to consider the size of the text, layout, and placement of the buttons to make it fairly simple to navigate even for unskilled users.

5.3. Limitations

It is important here to mention the limitations of this study. The people participating in this experiment are not randomly sampled. All the participants who joined this experiment showed an interest and curiosity in this project and were enthusiastic about trying it out.

6. Conclusion

In summary, older adults want to participate in society and would love to engage in prosocial behavior as they showed complete readiness in working as volunteers just as we hypothesized; however, there are several obstructions preventing them from doing so. We set out to explore whether the teleoperation of a robot was a suitable way for older adults to participate in society and we have found that it was generally effective. Older adults positively received the teleoperation experiment and were able to engage in volunteer work with very little difficulty. It was also very effective in easing communications as a layer of anonymity between the operators and visitors is added. Therefore the first two of the following steps have been achieved in this work:

- Verify whether older adults have a desire to engage in prosocial behavior, and what factors are obstructing them.
- Provide the means for older adults to overcome the barriers preventing them from engaging in prosocial behavior.
- Improve and reinforce people's desire to engage in prosocial behavior.

The third step, which will be a part of our future work, is increasing the desire to engage in prosocial behavior for people in general and not just older adults. For our future work, some improvements need to be implemented for the system, such as fixing the time lag issues caused by RoBoHoN's speech synthesis mechanism, and making the teleoperation interface easier with a better layout and font that can make navigation simpler for older adults. In addition to improvements in system design, we also want to test the system in different locations and for different purposes such as placing RoBoHoNs at tourist sites, where older adults operating the robot can give information to visitors and can act as their tour guides. We would also like to improve support for operators of the system by helping them maintain interesting conversations. The system would provide topic points to efficiently steer the conversation while keeping the visitors interested and engaged in the conversation. As talking to strangers might be stressful and intimidating, this might help the operators to be more comfortable by helping them steer the conversation and create a more fun environment for the visitor. This can also be helpful in scenarios where the RoBoHoN is placed in touristic spots, the system can give the operator information regarding the spots and artifacts available in that location, thus allowing them to volunteer as tour guides even when they don't possess the required knowledge.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee for Research Involving Human Subjects at the Graduate School of Engineering Science, Osaka University. The participants provided their written informed consent to participate in this study.

Author contributions

EM: investigation, analysis, and writing—original draft. TH: investigation and analysis. RY: conceptualization, methodology, and writing—review and editing. SN: conceptualization, methodology, software, and writing—review and editing. HI: funding acquisition. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Older adults' experiences with using information and communication technology and tech support services in New York City: findings and recommendations for post-pandemic digital pedagogy for older adults

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Introduction: Although Information and Communication Technology (ICT) has great potential to help older adults cope with challenges associated with aging, the intended benefits of ICT are not always realized in this population due to access barriers and low digital literacy. During the COVID-19 pandemic, numerous tech support initiatives for older adults got underway. However, evaluation of the effectiveness of these initiatives is less common. This research partnered with a large, multi-service organization in New York City that gave some groups of their clients ICT devices, unlimited broadband, and access to technology training in response to COVID-19 lockdowns. This study investigates older adults' experiences with ICT and ICT support services to better inform the existing and emerging tech support for older adults during and beyond the pandemic.

Methods: Data were obtained from interviewer-administered surveys of 35 older adult recipients of ICT devices, connectivity, and training in New York City. The average age was 74 years (range = 55–90 years). The group was diverse regarding race/ethnicity (Black 29%, Latino 19%, White 43%). All had low incomes. Surveys consisted of multiple-choice items and open-ended responses.

Results: The study found that one size does not fit all when it comes to ICT training and support for older adults. While connection to devices and services and tech support led to a degree of ICT adoption, the newly learned skills did not always lead to expanded device usage. The readily available tech support training and support do not guarantee service utilization, as success with tech services is related to one's pre-existing ICT competence.

Discussion: The study concludes that customized training based on individuals' skills rather than age is needed. Tech support training should start by understanding an individual's interests and incorporate tech education to help users identify a wide range of existing and emerging online services that can meet

their needs. Service organizations should consider including an assessment of ICT access, use, and skills into their standard intake protocols to ensure effective service delivery.

KEYWORDS

older adults, aging, information and communication technology, technology support, technology training for older adults, COVID-19, survey research

Introduction

Information and communication technology (ICT) use was necessary to stay socially connected and capable of receiving many health and social services during the COVID-19 pandemic shutdowns. ICT access was particularly important for older adults who were under the most stringent isolation protocols (Llorente-Barroso et al., 2021). While early reports had optimistic projections of older adults' adoption and ownership of ICT over the years, especially during the course of the pandemic (Kakulla, 2021; Faverio, 2022), many studies warned that such growth often only represented a shift from "have nots" to "haves" (Freeman et al., 2022). In other words, the mere possession of ICT devices is not enough to guarantee meaningful digital access and engagement. Compared to younger adults, older adults tend to have overall lower digital literacy and less success in efficiently achieving their goals and accurately addressing their needs as a result of internet usage (Van Deursen, 2020).

It is crucial to treat older adults not as a monolithic group of technologically-incompetent users. Older adults possess a wide range of digital skills and engage with ICT in varying ways (Van Deursen and Helsper, 2015a; Hänninen et al., 2020). However, the digital divide between older and younger adults in infrastructural access and digital literacy still remains (Smith, 2014; Hecker et al., 2021; Perrin and Atske, 2021). The 2022 Pew Research Center survey found that 86% of those ages 30–64 owned broadband access at home compared to 61% of those ages 65 and older (Faverio, 2022). Among the older adults who are connected, despite the subset of older adults who are proficient in technology use, compared to the younger population, the overall older population is at lower odds of integrating internet use into everyday activities and uses the internet in more limited ways owing to lower literacy, inability to see the benefits of online engagement, and, sometimes, genuine disinterests in using the internet (Quan-Haase et al., 2018). Some older adults reported being overwhelmed by the variety of ICT functions and struggling with a lack of clear instructions and adequate support, which resulted in an inability to expand usage and increasing frustration with learning new things (Vaportzis et al., 2017; Harris et al., 2022). As a result of rapid digitalization and persistent issues related to the digital divide, some older adults had to give up on certain activity engagements as these activities became no longer available offline (Reneland-Forsman, 2018).

The digital divide became even more visible as the US service organizations transitioned overnight to remote service delivery in March 2020. Many older adults faced obstacles and steep learning curves. Although the pandemic has pushed many older adults to use ICT to some extent to communicate with social networks and keep up with information, many functions and applications of ICT remain poorly utilized and understood. Reports on older adults' digital engagement during the pandemic have found significantly less ICT usage among older adults to manage daily activities and access health services (Lam et al., 2020; Kakulla, 2021; Perrin and Atske, 2021). In the same 2021 AARP Tech Trends report that highlighted older adults' new tech purchases during the pandemic, more than half of the surveyed older adults (n = 2,271) reported needing additional support with their purchased devices and almost 40 percent of them lacked digital confidence (Kakulla, 2021).

Meanwhile, socio-demographic factors also impact older adults' internet usage. Declining internet usage has been associated with growing age and those above age 75 are less likely to access the internet than those from the younger group of older adults (65–74) (Smith, 2014; Crouch and Gordon, 2019; Sixsmith et al., 2022). Studies have also found that adults with higher educational status in early life were more likely to engage in internet use in later life (Leukel et al., 2021). In addition, ICT adoption patterns are also influenced by an individuals' physical and cognitive capability. Visual and hearing impairment and memory loss in older adults are associated with decreased usage of the internet (Gell et al., 2015; Choi et al., 2020; Lam et al., 2020). All the existing studies and reports have underlined the need to implement appropriate and adequate tech support and training for older adults.

Previous researchers have explored older adults' ICT learning technology support needs and learning preferences. Recognizing a wide range of skill levels and needs across individuals, studies identified a demand for personalized support that fulfills a broad range of interests (Barnard et al., 2013; Hunsaker et al., 2019; Schlomann et al., 2022). Older adults with sufficient internet skills may not need tech support or emphasize getting the support that expands their ICT abilities to engage in a broader range of digital activities (Quan-Haase et al., 2018; Hunsaker et al., 2019). To older users who are more dependent on others' support, the availability and immediacy of help is a critical matter (Hunsaker et al., 2019). While formal technology support and training is also identified as one of the technical support sources among older adults, due to concerns related to cost and accessibility, many reported getting help from informal sources such as their families and friends who are known as "warm experts" (Lafontaine and Sawchuk, 2015; Hunsaker et al., 2019; Hänninen et al., 2020). Introduced by sociologist Bakardjieva (2005), the term warm expert refers to more technologically experienced individuals who are in a tech novice's close social network, who help inexperienced tech users to solve their technical problems and contribute to their learning process. To older adults, 'warm experts' typically are their close personal networks, such as families, friends, peers, and social service providers, who are able to offer personalized support in a timely manner (Olsson and Viscovi, 2018; Hänninen et al., 2020;

Hunsaker et al., 2020; Nordin et al., 2021). Moreover, as indicated by Quan-Haase et al.'s (2018) study, tech support might not be desired by all older adults with limited skills and experiences, as some place more value on offline engagements and perceive the tech learning process as a waste of time and effort.

Regarding device preferences, some older adults find it easier to use tablets than mobile phones or laptops, as tablets provide larger screens than regular phones but allow more flexibility than computers (Chan et al., 2016). Likewise, smart (i.e., internet capable) TVs have been identified as appropriate and effective learning tools for older adults because TVs provide a familiar and easy-to-use interface for the older population, helping to minimize technology resistance and anxiety (Santana-Mancilla and Anido-Rifón, 2017; Andreadis et al., 2021; Wang and Wu, 2021).

As shown, past research has well demonstrated older adults' heterogenous digital engagement patterns, infrastructural access and narratives on preferences in adoption. However, there is insufficient research that extensively and empirically interrogates older adults' experiences with an existing tech support service. While many studies interrogating older adults' support needs took place before the COVID-19 crisis, the arrival of the pandemic has changed the techno-social environments for many as the integration of ICT use into everyday life has become more necessary than ever. Meanwhile, throughout the pandemic, the importance of technology support services for older adults has been highlighted as health and community-based organizations pivoted to virtual service delivery and programming. Numerous efforts have been made by both the public and private sectors to support older ICT learners. Nevertheless, the effectiveness of these initiatives has not been examined for the most part. In this study, we have an opportunity to examine older adults' real-life experiences and behaviors with regard to tech support usage during the pandemic in a small sample. This study takes advantage of a setting where material access problems were solved (as people were provided free devices and broadband connection) and available training and tech support services were provided, to ask what are the further barriers and facilitators to older adults' effective usage of ICT during the pandemic and beyond?

In this study we evaluate the effectiveness of ICT support through the meaningful access framework. In the past decade, the digital inclusion/exclusion framework had gradually moved from a broad discussion of the differences in physical access to a nuanced recognition of differences in attitudes, types of engagement, skill levels, and the tangible outcomes as result of ICT usage (Witte and Mannon, 2010; Van Deursen and Helsper, 2015b). This framework conceptualizes three levels of digital divide. The first level concerns disparities in infrastructural access; the second level focuses on gaps in skill levels, digital literacy and uses; and the third level assesses the differences in the impact generated by internet use (Van Deursen and Dijk, 2014; Van Deursen and Helsper, 2015b). Translating such theoretical framework to the policy work focusing on ICT and older adults, the Brookdale Center for Healthy Aging identified four essential components that constitute meaningful digital access for older adults: a usable device, adequate broadband internet service, the education to foster skills, and ongoing technical support to ensure one's capability to navigate the internet independently to meet one's needs (González-Rivera and Finkelstein, 2021). Consistent with the framework for digital inclusion, Brookdale's meaningful access concerns not only the basic infrastructural capabilities or possession of basic skills to go online but also one's capacity to make use of the internet independently and benefit from everyday digital engagement. Therefore, successful education and tech support should result in knowledge about the usefulness of ICT including its specific functions and platforms that fuel motivation, and effective performance of online activities that ensure meaningful access and realize the intended benefits of ICT for older adults (González-Rivera and Finkelstein, 2021).

We partnered with a large organization serving older adults in New York City which had launched an ICT enhancement initiative for its clients in response to the COVID-19 pandemic. The specific group receiving these devices included all the residents of one independent living apartment building for older adults; participants from a chronic disease self-management program; clients of mental health clinic; participants from a palliative care program; and participants from several senior centers (voluntary recreation and meal sites for older adults living in the community). All of them were connected to a variety of resources and stably housed. Following the COVID-19 lockdown, this organization provided groups of their clients ICT devices, including laptops, tablets, and TV set top boxes that connected to the internet (i.e., smart TVs). Clients did not have their own choice of device; different devices were available in different settings. However, in all instances, this initiative included installation assistance, user manuals, free unlimited broadband, and ongoing technology training and support services provided by two tech support organizations who were experienced in working with older adults. Additionally, clients were able to receive support from the service organization's staff members whom they knew well, which facilitated self-paced learning. We evaluated the impact of this effort and explored older adults' experiences with ICT support services. Given the combination of removal of infrastructural barriers (devices, set up, connection all provided) and provision of training and ongoing support, this initiative offered a useful opportunity to investigate older adults' engagement with ICT devices and the efficacy of ICT technology support. This study aimed to: (1) better understand the technology competence, use, and barriers of older tech service recipients who participated in this program; (2) provide guidance about the impact of various components including the use of specific devices, connectivity, training, and support services; (3) evaluate the strengths and weaknesses of the organization's tech access programs; (4) ultimately, present evidence useful for the future creation and expansion of technology services for older adults. We attempt to address gaps in the current literature by exploring not only older adults' interactions with internet-connected devices but also, specifically, their experiences with ICT support services.

Materials and methods

Service program specifics

The organization distributed internet-capable devices and broadband access to five groups of program participants. The specific details of the programs are presented below:

- Wired a senior residence for wifi and provided residents with a laptop and tech support services. Tech support services included initial device installation, lessons, and ongoing remote services provided by the company's staff specializing in services for older adults to support participants' tech use whenever problems arise. Services were provided in English, Russian, and Hebrew.
- Provided tablets and tech support services to participants in three of the organization's service programs: mental health, chronic disease self-management, and palliative care.Tech support services were the same as for people in the residence.
- Distributed TV set top adapters for internet connection to senior center participants to enable access to various interactive virtual programming, including fitness classes, peer networking, and professional development sessions. Tech support was offered by the provider of the adapters, and included installation and ongoing tech support through a helpline.

Data collection procedures

This evaluation utilized a survey research design. Because of the patient confidentiality regulations at the studied research site, our researchers were not allowed to recruit participants directly but through the support of the service organization's staff members. While the number of participants reached during the recruitment process was unknown, a total of 35 older adults reached out to our researchers via a given contact number and were interviewed. Additionally, we communicated with the two tech services providers, program leads and the sponsoring organization's site staff directly, which supplemented the data collection effort. The program evaluation protocol was approved by the City University of New York Institutional Review Board.

To maintain client confidentiality, we used a passive recruitment strategy. Data collection took place primarily between January 2022 and March 2022. Based on clients' demographic information provided by the older adult's organization and within the linguistic capacity of our research team, we sent flyers in English, Russian, and Spanish to the five respective program leads, who then distributed the recruitment flyer to all program participants who had received devices. Interested clients called a number provided on the flyer to schedule 30-minute interviews by phone. Prior to the interview, respondents provided verbal informed consent and were guaranteed anonymity and confidentiality of their information. Interview data were recorded in Qualtrics survey software. Non-English speakers had the option to be interviewed in Spanish or Russian, but all interviews were conducted in English. Respondents were compensated for their time with $20 gift cards.

Data collection instrument

The questionnaire was organized into six domains: demographics, self-assessed wellness, social connection, technology use, technology support, and technology attitudes. In addition to providing personal baseline information, including health status and familiarity with computers, respondents were asked to:

- Assess change in contact and feelings of closeness with their social networks compared to before COVID-19, change in using technology to connect with social networks since COVID-19.
- Rate the frequency and ease of use of internet-connected devices (tablets, TV boxes).
- Describe the assistance and support provided by the tech providers, when relevant.
- Describe their experiences with the devices, as well as the impact those devices have had on their daily lives.
- Assess their level of skill and confidence in conducting various online activities.
- Assess their satisfaction with participating in the program and importance of an internet connection during the pandemic.
- Assess loneliness using the 3-item version of the UCLA Loneliness Scale (Russell, 1996), a commonly used measure for older adults. The UCLA Scale demonstrated high internal consistency in this sample (Cronbach's alpha = 0.88).

The majority of questionnaire items used categorical or Likert-type scale responses. However, each section also included open-ended questions, including items specific to experiences with the laptop, tablet, and TV set-top devices, as well as the initial installation, training, ongoing support, and barriers to/facilitators of device utilization to allow for a greater depth of information.

Findings

Description of the sample

We recruited a diverse sample of participants with regard to age, race/ethnicity, and physical and mental health conditions. Almost half of the participants (16) were between 70 and 79 years old, and 8 participants were 80 years of age or older [see **Table 1**]. More than half of the participants were Black/African Americans and Latinx. Since the sponsoring organization serves low-income older adults, participants were low-income. However, no one was precariously or unstably housed as the organization provides housing and/or housing support.

A majority of participants (n = 22) reported trouble using their hands due to arthritis. Nearly half (n = 14) reported trouble seeing even with glasses or contact lenses, and 7 had difficulty hearing even if using a hearing aid. No one reported severe cognitive declines while a few (n = 8) reported having somewhat poor memory. A majority of participants reported that their daily activities had either been severely restricted (n = 2) or somewhat restricted (n = 19) by their physical health. In terms of mental health, while most participants reported overall good mental wellbeing, two reported that their mental health had severely affected their ability to perform daily activities. Despite repeated attempts and substantial effort by the organization's program staff, no clients from the palliative care program answered the survey. Program staff provided their perspectives on the reasons for this lack of response, which are incorporated into findings and practical implications.

TABLE 1 Program details and demographic characteristics tech recipient user type.

	Total	
	N	%
Senior residence–chromebook	7	20.6
Mental health program–tablet	9	26.5
Chronic disease management–tablet	6	17.6
Senior center–TV box	12	35.3

	Total		Experienced		New adopter		No mastery	
	N	%	*N*	%	*N*	%	*N*	%
Age group								
55–69	9	27.3	4	40.0	4	26.7	1	12.5
70–79	16	48.5	2	20.0	8	53.3	6	75.0
80–90	8	24.2	4	40.0	3	20.0	1	12.5
Gender								
Female	28	82.4	8	80.0	13	81.3	7	87.5
Male	6	17.6	2	20.0	3	18.8	1	12.5
Race/ethnicity								
Black	12	37.5	4	40.0	6	37.5	2	33.3
White	11	34.4	6	60.0	4	25.0	1	16.7
Hispanic	6	18.8	0	0.0	4	25.0	2	33.3
Other	3	9.4	0	0.0	2	12.5	1	16.7
Marital status								
Single	6	18.8	2	22.2	1	6.3	3	42.9
Married/partner	5	15.6	2	22.2	3	18.8	0	0.0
Divorced/separated	5	15.6	2	22.2	3	18.8	0	0.0
Widowed	16	50.0	3	33.3	9	56.3	4	57.1
Lives alone	25	75.8	8	80.0	12	75.0	5	71.4
Retired	32	94.1	9	90.0	16	100.0	7	87.5
Last job								
Unskilled	1	3.0	1	10.0	0	0.0	0	0.0
Skilled	12	36.4	3	30.0	7	46.7	2	25.0
Professional/managerial	10	30.3	2	20.0	5	33.3	3	37.5
Proprietor	8	24.2	3	30.0	3	20.0	2	25.0
Volunteer	1	3.0	1	10.0	0	0.0	0	0.0
Never worked	1	3.0	0	0.0	0	0.0	1	12.5
Used tech last job	15	44.1	4	40.0	7	43.8	4	50.0

Experienced $N = 10$. New adopter $N = 16$. No mastery $N = 8$. CDSM, chronic disease self-management. Only valid responses shown.

Resolved infrastructural access barrier leads to a degree of ICT adoption

Overall, most participants already had or attained some proficiency through the technology support programs for at least some ICT functions. Those individuals shared rather positive attitudes toward ICT use and reported that using the internet was very important during the pandemic ($n = 30$) and that their experiences with ICT devices and support services were good or very good ($n = 31$). One person shared that, "It's unbelievable what that monster can do. I can't live without it. It's the center of my life."

Free devices and the internet are shown to be one of the facilitators for participants to adopt ICT. One person stated: "I take full advantage of it. It was given to me as a gift and it would be selfish not to use it." Another participant who previously did not have a device expressed her joy upon receiving her tablet: "I always wanted one. And [the organization's name] gave me one!" Although this participant still struggled to use most of the device functions, the participant learned how to send emails and use zoom to take guitar classes. As the first-level of the digital divide was

solved through free devices and broadband, some individuals who were initially hesitant about using devices became more open to the idea of ICT use. One person shared: "I stopped using it at the beginning. But then I thought, they took all this energy to give me this thing, I'll give it another try. . .I've been very happy with the online offerings. It has enhanced my life a lot." To some, it was the combination of the free devices and the impact of COVID-19 that made them appreciate the ICT utilization: "Before covid, it was better. We would go to the theater, museums, and concerts. Now, the world is more narrow. But the computer helps expand it."

These findings are consistent with several studies, suggesting strongly that the belief that most older adults lack the ability and desire to learn ICTs is simply not accurate (Vaportzis et al., 2017; Sixsmith et al., 2022). Older adults are capable of improving their life through ICT usage with appropriate support (Francis et al., 2019). The design of this tech-enhancement program—eliminating basic infrastructural barriers– supports the explanation that much non-use of ICT by older adults stems from a lack of infrastructural access rather than a lack of interest. At the same time, material access issues, such as concerns with the cost of devices and the internet, affect many digitally marginalized communities regardless of age.

Health characteristics in dialog with tech usage

While past research revealed a significant association between physical and mental health challenges and reduced technology use among the older population (Smith, 2014), we found a more complicated relationship between health and tech use after the access barriers were removed [see **Table 2**]. There were a total of 8 infrequent users/non-users among the 35 people surveyed who reported no or very infrequent use of their devices. Interestingly, while the prevalence of respondents reporting either difficulty seeing, hearing, or using their hands was high among participants (41, 21, and 65%, respectively), they were NOT overrepresented in the group who did not adopt devices. Such a non-associative relationship between tech use and health conditions further shows that once the access barriers are solved, the impact of health-related barriers is mitigated.

Nevertheless, although self-reported difficulty seeing, hearing, and using one's hands did not hinder adoption, it does appear that there are states of disability, physical or mental, beyond which interest in or capacity for ICT is not present. Among the 8 infrequent users/non-users, there were 3 respondents who reported bad/very bad physical and/or emotional health. Half of them were very challenged during the tech enhancement program period, including one reporting having had suicidal thoughts, another who "lost" the use of device immediately and could find no help, and another who reported being unable to read and, therefore, unable to use the device[1]. The finding that some people find ICT adoption out of reach due to their health is further supported by our unsuccessful attempt to reach clients from the organization's palliative care program. While a 2016 systematic review of ICT usage in palliative care pointed to the potential of ICT in aiding decision-making, the particular research field is small (Ostherr et al., 2016), with a sharp focus on ICT adoption from care providers' perspectives than patients' (Portz et al., 2020; Mills et al., 2021). Echoing many others, this research calls for more future research to continue exploring questions pertinent to adoption patterns among older palliative care patients.

Utilization of tech support services is related to degree of ICT competency

The 35 people we surveyed were categorized into three groups based on their responses to questions about their technology use before the new devices were distributed and their responses to questions about functions, frequency, and ease of use of the new devices. People (n = 10) who already had ICT competence (most also already owned at least one device before the program) and then added use of the new device were categorized as "experienced." Those (n = 17) who had little/no previous experience with ICT and gained the competence and confidence to do several functions on their new device and did so at least weekly were categorized as "new users." Those who reported less than weekly use and no specific functions used (n = 8) were categorized as "infrequent users/non-users."

About one-third of the respondents (n = 10) already had experience using an internet-connected device (desktop computer, tablet, laptop) before they received their new devices as part of the program. Not surprisingly, this group uniformly found the new devices easy/very easy to use. They were also the group that was the most likely to request and successfully receive training and technical assistance from the tech support companies. These respondents were typically happy to receive a new device and often reported using it differently than their existing one. They often described the tech support service as "available" and "helpful." Many called tech support for troubleshooting whenever they encountered problems. One participant took advantage of the training class to expand their tech skills: "I already know how to use a computer. Also, [the organization's name] gave me very good computer classes." Another participant successfully acquired skills to set up and use their new tablet by contacting technology support services and even offered assistance to their peers: "[The name of the technology service] girls were very helpful. I taught myself based on what they said. Then I helped others, about 30 to 40 people in the building! I'd go house to house."

Almost half the participants were the agency's intended target for the ICT distribution and training program: older adults who did not have access to devices and the internet at the start of the pandemic and gained it through this initiative. Sixteen of the people interviewed who reported no previous experience with ICT were pleased with their tech-learning experiences. However, in contrast to the "experienced" group who benefited most from the tech support programs, most "new users" did not seek further support from the formal tech support program following the initial start up session. Of those who did, several reported that the tech support program was not helpful. As one participant summarized succinctly, "It's all very simple to understand. We needed private

1 The participant reporting suicidal ideation was immediately reported to the service organization, who was familiar with the person's situation and provided additional clinical support.

10.3389/fpsyg.2023.1129512

TABLE 2 Health characteristics by tech recipient user type.

	Total		Experienced		New adopter		No mastery	
	N	%	*N*	%	*N*	%	*N*	%
Trouble seeing	14	41.2	4	40.0	7	43.8	3	37.5
Trouble hearing	7	20.6	4	40.0	2	12.5	1	12.5
Trouble using hands	22	64.7	6	60.0	11	68.8	5	62.5
Self-rated memory								
Very bad	0	0.0	0	0.0	0	0.0	0	0.0
Somewhat bad	3	8.8	0	0.0	2	12.5	1	12.5
Neither good nor bad	10	29.4	3	30.0	4	25.0	3	37.5
Somewhat good	15	44.1	5	50.0	8	50.0	2	25.0
Very good	6	17.6	2	20.0	2	12.5	2	25.0
Self-rated health								
Very bad	1	2.9	0	0.0	0	0.0	1	12.5
Somewhat bad	2	5.9	0	0.0	1	6.3	1	12.5
Neither good nor bad	11	32.4	4	40.0	5	31.3	2	25.0
Somewhat good	15	44.1	5	50.0	8	50.0	2	25.0
Very good	5	14.7	1	10.0	2	12.5	2	25.0
Self-rated quality-of-life								
Very bad	1	3.0	0	0.0	0	0.0	1	12.5
Somewhat bad	2	6.1	1	10.0	1	6.7	0	0.0
Neither good nor bad	4	12.1	1	10.0	1	6.7	2	25.0
Somewhat good	15	45.5	3	30.0	9	60.0	3	37.5
Very good	11	33.3	5	50.0	4	26.7	2	25.0

Experienced $N = 10$. New adopter $N = 16$. No mastery $N = 8$. Only valid responses shown.

tutors. How do you give computers to people who never used them without any basic education? Those who already owned computers benefited. Others, of course not."

Most of the time, among the new users, consistent with previous research (Lafontaine and Sawchuk, 2015; Hunsaker et al., 2019; Hänninen et al., 2020), warm experts, including families, peers, and the organization's social service staff, were the preferred sources of technical support. Although everyone we surveyed was aware of the existence of the professional tech support services, most reported not requesting any assistance from tech support. One participant shared the story of having their daughter contact the tech support for help.

Inability to apply learned skills to expanded usage

While most respondents learned to use their devices, for many, the functions they used regularly were somewhat limited, and centered on the core functions the organization needed them to master in order to maintain the continuity of services during the COVID-19 lockdowns.

As shown in **Table 3**, the majority of the laptop and tablet recipients reported that they could do a suite of functions well or very well. These tasks included sending/receiving email, online shopping (though a significant minority —43% report not doing this at all), reading online publications, accessing educational and recreational sites (like senior centers), playing games, watching TV online, receiving video calls, communicating with a case manager or service provider, and taking classes online. The online functions that were less frequently endorsed included: online banking, accessing benefits information, accessing social media sites, participating in chats or blogs, and using telehealth services. There was a sizable minority who reported only using their device to interact with the service provider, like answering Zoom calls from the organization's workers and participating in online classes offered by the organization. A few could do some online tasks, such as watching TV online and accessing zoom, but were unable to do other things like reading newspapers online and playing games.

This suggests that many people mastered what they were explicitly taught, but are less inclined to venture further into the options/opportunities their devices provide or transfer the learned skills to perform other activities. This is consistent with our previous research that for people for whom ICT is new, it is not always evident what the device is useful for, even when some skills are gained (González-Rivera and Finkelstein, 2021).

Discussion: moving forward

In examining older adults' experiences with an existing tech support service during the pandemic, the majority of the findings of this study are consistent with past findings on

older adults' heterogenous internet use and engagement in the pre-pandemic era. The results of our study once again show that older adults possess a range of tech skills and needs that require different levels of training and support based on an individual's skills and needs (Hunsaker et al., 2019; Schlomann et al., 2022).

Importantly, this study found that those with previous tech experiences and a degree of digital literacy benefited most from the tech support service. New users with limited tech experiences continue to prefer "warm experts" as their instructors. Some past studies ascribed the inability to participate in formal tech service support and training to a lack of availability, immediacy, affordability, and accessibility (Hunsaker et al., 2019; Hänninen et al., 2020). However, in this research, although all the participants were aware of the readily available professional tech support staff who offered free support, the new ICT users still more frequently sought support from families, friends, and their regular support providers who may not be the tech-teaching experts. A possible explanation could be that those with more tech knowledge are better at recognizing and articulating the specific problem they have encountered and the particular support they need (Hunsaker et al., 2019). Meanwhile, new learners may prefer informal learning environments and obtaining help from those they have close relationships with, which helps relieve tech novices' stress and fear while learning new things (Lafontaine and Sawchuk, 2015).

The uneven utilization of ICT functions and applications may partly be the result of being taught "how to do this" without understanding "what this is good for." In this specific program, the organization offered the devices and training in an emergency situation with the goal of continuing to keep older adults connected to their services during the pandemic. The people in this program learned the computer functions they were explicitly taught. Many of our informants did not recognize the implications for other uses from what they were taught. While such forms of tech support could be effective and appropriate in addressing older service recipients' immediate needs during a time of crisis, it remains crucial for future tech support programs to create learning tools that allow older adults to translate learned skills to a broader range of online activities based on their needs and goals (Quan-Haase et al., 2018).

Our previous analysis of the New York City census re access to technology found predictors of internet access among older adults included younger ages, higher levels of formal education, higher income, and living with others (González-Rivera and Finkelstein, 2021). Other studies report that people in poorer physical, emotional, and cognitive health are less likely to adopt ICT (Crouch and Gordon, 2019; Leukel et al., 2021; Sixsmith et al., 2022). Among our informants, ICT adoption was not associated with younger age, higher education, and health conditions. While many of these participants were low-income and racial and ethnic minorities, all were clients of a large aging services organization and, therefore, were connected to a variety of resources and stably housed. Therefore, we understand this finding as supporting the idea that material access barriers and socioeconomic disadvantages may drive much of the lower uptake of ICT among older adults in the overall population in New York City.

Moreover, despite the infrastructure and technical support provided, some participants did not use any ICT and others used it in limited ways. Those who reported very limited usage and knowledge of ICT devices were in overall good health and were not miserable. To quote one participant: "I meditate and pray every day. I read spiritual material, do puzzles, keep myself busy and I don't feel lonely. I draw and do math. I got the tablet in the mail, but don't know how to use it." Even during a time of crisis when technological competency was regarded as a determinant of quality of life, consistent with the previous findings before the pandemic, older participants did not let their tech skill levels impact their social involvement and exhibited a high level of autonomy in deciding the ways to live their lives (Quan-Haase et al., 2016, 2018).

Tech support design and policy recommendations

Our findings have implications for program and policy. First, "purpose built" training may not optimize all the possible ways to access the many functions and range of online experiences enabled by these devices. It is important to incorporate tech education into the tech support services that can keep older people updated on the wide range of existing and emerging online services they could benefit from. As many existing studies have pointed out, the perceived usefulness of the internet is one of the motivators for internet use among older adults (Yap et al., 2022). Therefore, tech support training should start by understanding an individual's interests and needs and build from there to help them identify ways ICT could help them meet these needs. Tech training and support staff for older adults need to be trained in incorporating such an educational component into their regular tech support services. In this case, even when an older client calls for help for one specific issue or skill, while assisting the targeted issue, the supporting staff should intuitively guide them through the various other options that one learned skill could be used for and applied to.

Second, service organizations should include assessment of ICT competency, use, and access into their standard intake protocols. We recognize that customization is difficult to implement in an institution or an organization serving a large number of clients or during times of crisis such as the onset of the COVID-19 pandemic. Therefore, we suggest that tech support services can consider ways to prospectively assess people's technology access and computer competence on intake and with periodic updates, like other components of a care plan.

Third, we encourage tech support services to also offer available training and resources to clients' social service providers to give them the necessary skills and tools to help older adults navigate ICT devices and ICT learning experiences. In terms of policy, we call for training for home healthcare workers to provide tech support and teaching skills. Additional funding would be required to pay workers with these new skills, which would cause a necessary and desirable increase in their wages. Further funding should also go to older adult centers, public libraries, religious institutions, and other community-based programs to develop or bring in adequate programs to help older members of their communities get the skills and support they need to become internet users.

Fourth, as suggested by the narratives of some participants who claimed that internet use was just unnecessary and non-usage from

10.3389/fpsyg.2023.1129512

TABLE 3 Self-rating of ability to do computer functions by tech recipient user type.

	Total		Experienced		New adopter		No mastery	
	N	%	*N*	%	*N*	%	*N*	%
Send/receive email								
Very well	12	36.4	8	80.0	3	18.8	1	14.3
Well	7	21.2	2	20.0	4	25.0	1	14.3
Fairly well	3	9.1	0	0.0	3	18.8	0	0.0
Poorly	2	6.1	0	0.0	2	12.5	0	0.0
Not at all	9	27.3	0	0.0	4	25.0	5	71.4
Online shopping								
Very well	12	36.4	6	60.0	5	31.3	1	14.3
Well	2	6.1	1	10.0	1	6.3	0	0.0
Fairly well	0	0.0	0	0.0	0	0.0	0	0.0
Poorly	1	3.0	0	0.0	0	0.0	1	14.3
Not at all	18	54.5	3	30.0	10	62.5	5	71.4
Reading online pubs								
Very well	12	36.4	4	40.0	7	43.8	1	14.3
Well	5	15.2	2	20.0	2	12.5	1	14.3
Fairly well	2	6.1	0	0.0	2	12.5	0	0.0
Poorly	1	3.0	0	0.0	0	0.0	1	14.3
Not at all	13	39.4	4	40.0	5	31.3	4	57.1
Online banking								
Very well	3	9.1	1	10.0	2	12.5	0	0.0
Well	5	15.2	3	30.0	2	12.5	0	0.0
Fairly well	3	9.1	2	20.0	1	6.3	0	0.0
Poorly	0	0.0	0	0.0	0	0.0	0	0.0
Not at all	22	66.7	4	40.0	11	68.8	7	100.0
Accessing benefit information or benefit application								
Very well	3	9.1	1	10.0	2	12.5	0	0.0
Well	3	9.1	2	20.0	1	6.3	0	0.0
Fairly well	6	18.2	4	40.0	2	12.5	0	0.0
Poorly	1	3.0	0	0.0	0	0.0	1	14.3
Not at all	20	60.6	3	30.0	11	68.8	6	85.7
Accessing educational or recreational site								
Very well	14	42.4	6	60.0	7	43.8	1	14.3
Well	3	9.1	1	10.0	2	12.5	0	0.0
Fairly well	2	6.1	0	0.0	0	0.0	2	28.6
Poorly	1	3.0	0	0.0	1	6.3	0	0.0
Not at all	13	39.4	3	30.0	6	37.5	4	57.1
Playing games or downloading media								
Very well	17	51.5	7	70.0	9	56.3	1	14.3
Well	2	6.1	1	10.0	1	6.3	0	0.0
Fairly well	3	9.1	1	10.0	1	6.3	1	14.3
Poorly	0	0.0	0	0.0	0	0.0	0	0.0
Not at all	11	33.3	1	10.0	5	31.3	5	71.4

(Continued)

10.3389/fpsyg.2023.1129512

TABLE 3 (Continued)

	Total		Experienced		New adopter		No mastery	
	N	%	*N*	%	*N*	%	*N*	%
Online phone/video calls								
Very well	13	39.4	6	60.0	6	37.5	1	14.3
Well	9	27.3	2	20.0	6	37.5	1	14.3
Fairly well	3	9.1	1	10.0	0	0.0	2	28.6
Poorly	1	3.0	0	0.0	1	6.3	0	0.0
Not at all	7	21.2	1	10.0	3	18.8	3	42.9
Social media sites								
Very well	11	33.3	6	60.0	5	31.3	0	0.0
Well	2	6.1	2	20.0	0	0.0	0	0.0
Fairly well	3	9.1	1	10.0	1	6.3	1	14.3
Poorly	0	0.0	0	0.0	0	0.0	0	0.0
Not at all	17	51.5	1	10.0	10	62.5	6	85.7
Chats/blogs/forums								
Very well	1	3.0	0	0.0	1	6.3	0	0.0
Well	1	3.0	1	10.0	0	0.0	0	0.0
Fairly well	1	3.0	1	10.0	0	0.0	0	0.0
Poorly	0	0.0	0	0.0	0	0.0	0	0.0
Not at all	30	90.9	8	80.0	15	93.8	7	100.0
Telehealth								
Very well	5	15.2	1	10.0	4	25.0	0	0.0
Well	7	21.2	5	50.0	2	12.5	0	0.0
Fairly well	4	12.1	1	10.0	2	12.5	1	14.3
Poorly	0	0.0	0	0.0	0	0.0	0	0.0
Not at all	17	51.5	3	30.0	8	50.0	6	85.7
Communicating with case manager/other helper								
Very well	8	25.0	3	33.3	5	31.3	0	0.0
Well	8	25.0	3	33.3	4	25.0	1	14.3
Fairly well	0	0.0	0	0.0	0	0.0	0	0.0
Poorly	0	0.0	0	0.0	0	0.0	0	0.0
Not at all	16	50.0	3	33.3	7	43.8	6	85.7
Participate in group activity or class								
Very well	18	54.5	7	70.0	10	62.5	1	14.3
Well	3	9.1	0	0.0	2	12.5	1	14.3
Fairly well	2	6.1	1	10.0	1	6.3	0	0.0
Poorly	0	0.0	0	0.0	0	0.0	0	0.0
Not at all	10	30.3	2	20.0	3	18.8	5	71.4

Experienced $N = 10$. New adopter $N = 16$. No mastery $N = 8$. Only valid responses shown.

the participants with extreme health challenges (including those from the palliative care), some from the current cohort of older adults may just prefer an offline lifestyle or do not have the capacity to learn and utilize a new skill. Therefore, information and social interaction must continue through multiple modalities for older adults and, we would argue, for populations of all ages with all kinds of ICT access barriers.

Limitations and strengths

This study is not without limitations. First, any recipient of the tech service programs in our partner organization was eligible to participate in the research. However, due to patient confidentiality guidelines at the studied service organization, our researchers were not allowed to recruit participants directly but through word of

mouth by the organization's service staff. Therefore, the number of participants reached remains unknown and the recruitment might have been biased toward individuals who had more success with their devices. It is reasonable to assume that those who did not utilize the tech devices or services were less inclined to participate. Secondly, since the participants had no choice of what device they were offered, we were not able to compare their preferences between devices. Third, the sample is rather small in this research. Future research may benefit from a larger research sample, which can generate more statistically meaningful findings.

Despite these limitations, this study provides unique insight into older adults' experiences with ICT during the pandemic. A key strength of the research is the diversity of the research sample, which encompasses a broad range of experiences by race, ethnicity, age, educational background, and health characteristics. Importantly, this study uniquely focused on older adults' technology support and training services during the pandemic. The research findings serve as additional evidence for future tech support and training design for older adults during the ongoing COVID-19 crisis and beyond.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving human participants were reviewed and approved by the CUNY Hunter College Institutional Review Board. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Analyzing the use of videoconference by and for older adults in nursing homes: an interdisciplinary approach to learn from the pandemic

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Introduction: During the Covid-19 pandemic and the resulting visitation restrictions, digital tools were used in many nursing homes in France to allow the older adults and their relatives to maintain social contact via videoconferencing. This article adopts an interdisciplinary approach to analyze the processes that affect the use of digital technologies.

Methods: Drawing on the concept of "mediation," it seeks to shed light on how individuals embrace these tools in a relational situation. The interviews and observations undertaken among residents, their relatives, professionals, and the management head of seven nursing homes in 2021, make it possible to outline the different forms of practices and uses and to identify the factors leading to the variations observed.

Results: While the key objective of these technical and technological tools is to compensate – on a functional level – for the communication problems and the isolation of individuals in order to promote residents' "quality of life" by maintaining "social contact," our study reveals that these tools' uses and practices largely differ. It also shows considerable inequalities in terms of residents' acquisition of subjective feelings of ownership of the tools. These are never attributed to isolated physical, cognitive, psychic, and social difficulties, but are influenced by specific organizational, interactional, and psychic configurations. Some of the structures analyzed revealed situations in which mediation failed, occasionally exposing the risk associated with seeking "ties at all costs," or revealing a disturbing strangeness when residents were placed in front of screens. Some configurations, however, showed that it was possible to set up an intermediate space for the experience to unfold, which in turn opened up a space where individuals, groups, and institutions could experiment, allowing them to develop subjective feelings of ownership of this experience.

Discussion: This article discusses how the configurations that failed to promote the mediation process reveal the need to assess the representations of care and assistance in the relationships between older adults, their loved ones, and nursing home professionals. Indeed, in certain situations, the use of videoconferencing,

while seeking to produce a positive effect, risks displacing and increasing the effects of the "negative" associated with dependency, which may worsen individuals' difficulties within nursing homes. The risks associated with the failure to take into account residents' requests and consent explain why it is important to discuss how certain uses of digital tools may renew the dilemma between concerns for protection, on the one hand, and respect for autonomy on the other.

KEYWORDS

nursing home, older adults, videoconference, COVID-19, mediation, play, consent, interdisciplinarity

1. Introduction: the context in which digital tools were used in nursing homes in France during the COVID-19 pandemic

During the COVID-19 pandemic in France, each nursing home sought to implement the national guidelines issued by the government from the first wave in March 2020. These nursing homes notably insisted on the suspension of visits and of residents' collective or individual temporary outings. New admissions were also put on hold. These recommendations meant that professionals began to prioritize interventions based on whether or not they were perceived as "indispensable" for residents' health, and those interventions judged to be indispensable were maintained in compliance with protective measures. Concerns about the isolation of residents led to the recommendations to create a space dedicated to private communications within the institution and to provide slots for making calls, except when residents' conditions did not allow motion. In the latter case, videoconferencing tools were recommended. Only a few exceptional situations (acute somatic or psychic decompensation, end-of-life situations) permitted the rules to be relaxed.

In this context, the CovidEhpad study (Balard et al., 2021) shows that the lockdown period was experienced in a largely heterogeneous manner which took contrasting forms depending on the modes of living in nursing homes as experienced by each resident, on the occupational or relational resources that the nursing homes succeeded in using, and on the residents' past. Moreover, while the COVID-19 pandemic limited the freedom of all French citizens, this constraint was even greater among nursing home residents, many of whom had multiple pathologies, coupled with cognitive impairments in some cases. Indeed, little attention was paid to residents' rights and ability to question this restriction of liberty (which is a constitutional right), to their self-determination, and to their consent to lockdown procedures in their nursing homes. These restriction measures were often linked to the degree of contamination in the institution. Moreover, radical measures were occasionally adopted locally in a context where the national framework remained vague and gave insufficient consideration to respect for the fundamental rights of nursing home residents (Defendeur of Rights, 2021). Internal inequalities also emerged between the residents, and while doors had to remain open in some nursing homes, they were allowed to stay closed in others. Some residents were also allowed to move around, for instance by going into the garden or up to the institution's doorstep.

To allow older adults and their loved ones to maintain ties via video-calls during the visitation restrictions, many French departments decided to distribute digital tablets in those nursing homes that lacked these tools. However, the dynamics of digital innovation in nursing homes still encounter great difficulties and have sometimes shown inconclusive results (Gaglio, 2018). For instance, many institutions – including those that participated in this study and irrespective of whether they had tablets before or during the pandemic – had no wifi connection and were able to "knock something together" by sharing the connection from professionals' smartphones. Moreover, most of those institutions that already had the equipment had not necessarily developed a genuinely digital culture which would have helped to promote social ties through these tools. Digital technologies were therefore primarily used by the social coordinators to propose activities within the institution.

During the Covid-19 pandemic and the associated visitation restrictions, many nursing homes in France opted for digital tools to support remote social contact between residents and their relatives. Initially, these tools sought to compensate, on a functional level at least, for individuals' inability to communicate – and/or for their isolation – with a view to promoting a "good enough" quality of life and to maintaining social ties. Their implementation, however, occurred in a context where major social changes have been gradually unfolding, changes of which the pandemic was simply an accelerator.

First, the Covid-19 pandemic, and the health measures implemented to address it, transformed individuals' social experiences: they undermined the conditions of stability and security in which social contacts were habitually made, they redefined the meaning of so-called "essential" activities, and they revived the dilemma of protection versus freedom with regard to health threats, in a context that privileges the "supposedly fragile" status of older adults (Sizoo et al., 2020; Gzil, 2021; Rosier and Hecketsweiler, 2021; Racin and Rocard, 2022).

Second, the increase in the number of digital tools proposed in nursing homes during this unprecedented period was also associated with the digital transformation of healthcare (Naik et al., 2022) and, more generally, with the rapid digitization of today's society. These tools are now widely used to maintain remote relationships among people under the age of 80, irrespective of whether they live at home or in nursing homes (Martins Van Jaarsveld, 2020). Multiple factors are thought to be behind the unequal access to these digital tools, such as the individual characteristics of the older adults, the tools' specific features, and the support one receives to enable them to embrace these tools (Mubarak and Suomi, 2022). However, rather than reduce these inequalities, the key objective of the unprecedented digital offer proposed in nursing homes during the pandemic was to address the risk of social isolation among the older adults (Chung et al., 2020).

In this context, based on a study of digital and organizational innovations seeking to promote social ties in nursing homes in the wake of the COVID-19 pandemic (Innovehpad), the following questions arise: what are the organizational, interactional, and psychic conditions that allow individuals and groups of professionals to use and embrace these digital tools? With what objectives in mind? Indeed, while these tools tend to reduce the inequalities associated with institutionalization, notably in terms of social isolation, they may give rise to, or reinforce, other types of inequality if one fails to consider whether or not they can be embraced, and the impact of their use or non-use.

2. Literature review: digital realities of older people in long-term care facilities during the visitation restrictions associated with the Covid-19 pandemic period

2.1. Remote social contacts in the fight against social isolation of older adults

The research studies on remote social contact among nursing home residents, which have emerged over the past 20 years, have primarily relied on semi-experimental approaches. These approaches suggest that a relationship exists between the social isolation of older adults and the increased risk of mortality and morbidity, particularly in terms of depressive syndromes (Krishnan et al., 1998; Seeman, 2000; Hybels et al., 2001). This isolation is largely associated with the fact that visits tend to decrease after institutionalization Tsai and Tsai (2015) as well as with the fact that some relatives are themselves very old, have mobility issues, or live in different geographical locations. Several authors argue that these factors call for changes in how we view nursing home residents' social interactions. One of the first studies to focus on this issue revealed that organizing video-conference sessions with families increased the quality of interactions – unlike reliance on audio sessions alone – because they made social presence more meaningful (Mickus and Luz, 2002). Remote social contact via videoconferencing tools allows participants to have a better assessment of how others are doing (Hensel et al., 2007). Videoconferencing use with relatives has a positive impact in terms of social support and reducing feelings of loneliness and depression (Tsai et al., 2010; Tsai and Tsai, 2011), thus making residents' daily life more fulfilling (Tsai and Tsai, 2010). Remote social contact via videoconferencing is considered to be the "second best option for visitation" (Tsai et al., 2010) for residents whose families live in different geographical locations.

Other studies, published during the visitation restrictions associated with the pandemic, have directly or indirectly focused on the remote social contacts of nursing home residents. All these studies have been based primarily on residents' real or supposed socialization needs (Lemaire et al., 2022). The research questions, often formulated from a negative angle, have focused on the absence of social contact associated with the pandemic context (Ayalon et al., 2020; Eghtesadi, 2020; Gallo Marin et al., 2020; Office et al., 2020; Pachana et al., 2020; Sano et al., 2020; Tsai et al., 2020; Bethell et al., 2021; Bolcato et al., 2021; Gorenko et al., 2021; MacLeod et al., 2021). While it is generally assumed that residents require digital technology to ensure social interaction, these residents' opinions are never sought. Their views regarding the people with whom they wish to communicate are never clearly explained, despite the fact that the available scientific literature focuses on multiple remote social contacts in a pandemic context (Lemaire et al., 2022). Indeed, several social interventions have been implemented, such as phone calls to older adults by student volunteers (Office et al., 2020), or video-conference sessions by certain associations (Burke, 2020). As part of an action research strategy aimed at setting up quiz sessions via Skype, remote social contacts between residents of several nursing homes were tested (Zamir et al., 2020), and several professionals asked to maintain remote contact with the residents (Pachana et al., 2020; Sano et al., 2020; MacLeod et al., 2021). While several authors suggest that it is important for older people to maintain meaningful relationships (Burke, 2020), or that some residents enjoy receiving calls (Office et al., 2020), it is not clear whether these residents had initially sought these social connections.

Several researchers have identified limitations of digital technologies, such as an inhibited use of videoconferencing due to residents' cognitive impairment, their physical fragility, and/or their visual or auditory disorders (Ayalon et al., 2020; Moyle et al., 2020; Sano et al., 2020; MacLeod et al., 2021). The digital divide has thus been addressed from several angles, including older adult's lack of digital skills (Lebrasseur et al., 2021). This divide also concerns the relatives of certain residents (Burke, 2020), especially because social inequalities limit access to digital technologies (Bolcato et al., 2021). Exclusion from technological progress is associated with negative representations of older adults, such as their passivity or their inability to learn (Eghtesadi, 2020). In the case of Telehealth consultations, remote contacts are declared necessary, irrespective of whether or not the older adults show an interest (Marsh et al., 2020). However, having access to technology does not mean that this technology is used in the most efficient way possible (Luscombe et al., 2021). We believe that remote social contact can only have a positive impact on social isolation and loneliness in a pandemic context if professionals support the use of digital technologies or convince the older adults under their care of such technologies' merits (Sacco et al., 2020).

As several authors have highlighted, this calls for changes in both the professionals' practices and in the infrastructure, an issue that received little attention before the pandemic (Schuster and Hunter, 2019). Indeed, several limitations have been highlighted, such as professionals being unavailable to set up videoconferencing, their lack of access to such technologies, and their lack of the necessary programming and facilitation skills (Freidus et al., 2020). Staff commitment and turnover is an additional limitation (Gorenko et al., 2021). Several factors must therefore be considered, for instance the purchase of dedicated equipment and infrastructure (e.g., setting up WiFi), the allocation of professional time to help older adults, and the consideration of staffing needs or volunteer training (Bethell et al., 2021).

Digital solutions are thus generally perceived as a more or less effective alternative to face-to-face interactions, albeit by default. They seem to respond to an "emergency" that may be real and/or symbolic, one which is focused on the risk of isolation and loneliness among the older adults, and therefore on the possible deleterious consequences in terms of their health and quality of life. Drawing on a normative (which determines the gap between *what is* and *what should be*) or even ideal (which determines the gap between the means available and the valued and/or valorized expectations) conception of the uses of digital technologies for older adults, there seems to be a tendency for

technological solutionism (Morozov, 2013). This conceals the social configurations suitable for significant contact, the unconscious mechanisms at play in these virtual interactions, and the specificities of the institutional context in which they unfold.

2.2. Representations of social contact among the older adults, considered from the perspective of the specificities of the nursing home context

Where the older adults are concerned, the risk of isolation and loneliness is an "evil" against which one must fight by making it possible to reflect on the individual and collective representations of geriatric institutions in our societies, which are often negative and marked by loss and death. The feeling of loneliness raises questions about how one relates to one's own self, deals with loss and separation, and occasionally aspires to be part of a whole, either as a couple or as part of a group, thereby filling existing gaps and preventing individuals from experiencing a certain capacity to be alone (despite the fact that this shapes the experience of dependency). This is because loneliness is less about the absence around oneself and more about the impossibility of addressing this emptiness within oneself. These feelings can be reactivated in cases of isolation, characterized by an absence of social contact and by fewer and less available substitute options when one ages. When the nursing home doors close, the absence of loved ones may increase the risk of psychological, cognitive, and/or somatic decline among individuals who are forced to face an additional loss while in a position of great vulnerability. Indeed, from the outset, life in a nursing home implies a radical and often definitive renunciation of one's previous life at home, a "home" (Milligan, 2016) which possibly served as a container and as a protective envelope (Eiguer, 2004, 2010, 2016; Zielinski, 2015), and which residents now have to reconstitute elsewhere (Ferreira and Zawieja, 2012; Charras and Cérèse, 2017). This separation also implies a rupture in the usual family and social relationships, as well as a withdrawal from social contacts, an experience likely to reactivate several losses (Riedl et al., 2013; Charazac et al., 2016; Racin, 2019). It also awakens several representations associated with the idea of irreversibility, which is itself frighteningly close to representations of death and to representations associated with the strong heteronomy inherent in these living spaces (Enriquez, 1987, 2006; Talpin and Ploton, 2002; Talpin and Minjard, 2021). Indeed, the representations of these institutions are still primarily defectological, meaning that they are centered on defects. They either view residents as the "dependent older adults," which is in continuity with the perception of the older adults as sick and mad, or they support today's ideal of "successful aging" (Billé and Martz, 2010). Consequently, nursing homes are viewed as failing in their socialization mission (*mésinscription*) or, as Talpin proposes Talpin (2021), failing as agents of deregistration (*désinscription*) insofar as older adults subjects in these homes, who often previously belonged to specific social groups (professionally, family-wise, etc.), lose their membership of these groups because of how old age and aging are addressed, on the one hand, and because of the frequent emergence or aggravation of cognitive and/or behavioral disorders, on the other. However, as Talpin (*op. cit.*) argues, these facilities also allow their members to regain membership, albeit of a stigmatized group (Goffman, 1961, 1963) as a result of impairments. These facilities have to deal with the "negative": negative deposited in their foundation (Pinel, 1996), negative of the older adults people cared for (*a fortiori* dependent), and negative of the professionals, irrespective of whether it is theirs alone or is associated with their encountering the older adults people for whom they care. As a result, a nursing home can only fulfill the healthcare mandate with which it was entrusted over the long term by working on itself, by making "detoxification" efforts, and by endlessly reflecting on anything that may attempt to dismiss – notably through denial and splitting – the negative aspects of castration, loss and death, of which the aging body, which is sometimes dependent and sick, bears the stigmata. A "pact on the negative" (Kaës, 2009) thus emerges in defense of an illusion that may lead to psychic damage and that could be exhausting for the subjects. This calls for intensive and continuous work within the institution to recognize the conscious and unconscious forces in the older adults cared for, as well as in their relatives and in the professionals. In nursing homes, the dependency paradigm (Charazac et al., 2016) shapes the relationships between the residents, their relatives, and the professionals and represents part of the "work of the negative" (Green, 1993) that institutions encounter. This dimension must therefore be considered in order to understand how it is renewed through the way in which older adults residents develop subjective feelings of ownership of those digital technologies aimed at maintaining social ties.

3. Methodology

3.1. Aims and objectives

First, we need to understand how digital tools can be used to provide a "positive" subjective experience for nursing home residents, by considering the variety of their possible uses. In particular, it seems necessary to analyze the uses that are situated in a functionalist or operational perspective – one focused on the functional dimension and on the operations that it is capable of ensuring – and those that are situated in a perspective that takes into account how these tools are actually embraced and the experiences of those that use them. The manner in which they embrace these tools can lead individuals to use them for purposes other than those for which they were initially intended. The challenge is therefore to specify the conditions under which these tools can be used with a view to promoting and developing the social relationships of the older adults residents.

The question of the conditions of use also raises the question of the *system* in which the technical tool is used, a question inseparable from the tool's operational or material dimension. Indeed, the system represents the structure established to enable access to the relational situation that videoconferencing targets and to the arrangements chosen to propose, host, make intelligible, and support residents' commitment to relationships via this form of communication.

Our approach differs from the descriptive and experimental studies which focus on the objective qualities that promote or act as an obstacle to the use of these digital technologies by various actors, the positive benefits of which are presumed from the outset. These studies do not make it possible to obtain a dynamic and relational understanding of the situations of use and non-use, which necessarily involves an analysis of the appropriate socio-technical configurations and the subjective experiences involved.

It therefore appears that the different uses of these digital tools shed light, retrospectively, on the theory of care and on the theory of suffering (Roussillon, 2010), which reemerge here. We posit that these theories are driven by the generally negative perceptions of nursing homes in today's society. Rather than analyze the effectiveness of the digital approach aimed at maintaining social ties, our study focuses on the processes at play in a situation that attempts to sustain relationships, but which is also *mediated* by digital tools, in order to shed light on how residents embrace these tools. Indeed, the technological support (in this case, video-calls using tablets) is not a simple neutral intermediary. It also promotes relationships (Akrich et al., 1988; Latour, 1991, 1999, 2000), with the participants using it not only to communicate but also possibly to negotiate about different issues affecting their relationships (psychological, social, organizational, etc.).

3.2. Mediation as an analytical tool

An analysis of the role that technological *mediation* plays in the relational dynamics of individuals thus appears important, meaning the manner in which digital tools allow the networking of human actors (healthcare providers, residents, relatives) who jointly develop (both humans and artifacts) social ties (Akrich, 1993). On a psychological level in particular, analyzing these uses from the angle of "mediation settings" (Brun et al., 2019; Brun, 2020) provides an excellent opportunity to comprehend the processes involved in the use of these technological tools. For instance, this can help to shed light on the adoption or rejection of these technical supports, or on the diversion from their original use, and thereby highlight the digital realities of older adults nursing home residents in the current post-pandemic society. Mediation is situated in a "space between" – between two spaces, between two moments – and only in this space can it make sense. Nursing-home professionals must also set aside a time and a space dedicated to connecting residents and their families. The mediating object drives transition, and the main effect of mediation strategies is that they bring together the conditions that make access to transitional phenomena possible; (Winnicott, 1951) these may be defined as unconscious phenomena which must be understood within the intersubjective contexts in which they take place. Transitionality unfolds within an intermediate zone of experience that supports the transition between two intersubjective states, making it possible to develop an experience in which one is continuously in rupture, i.e., connected but separated. As Kaës points out, "the consistency of the concept of the intermediary is that it expresses this triple function: bridging a maintained rupture, transforming recovery, and symbolization" (*op. cit.* 20).

3.3. Research questions

We therefore reflect on the multiple modes of use of digital tools and analyze the role that these play in ensuring that social contact is maintained in a context that associates multiple needs and desires that are yet to be identified. The question, then, is how likely are digital tools to accomplish a mediating function that connects both intrapsychic and intersubjective dimensions? To this end, we will examine the conditions under which older adults nursing home residents, who are sometimes extremely hampered in their physical, cognitive, and psychic abilities, acquire subjective feelings of ownership thanks to their use of digital tools within an approach that seeks to promote mutual relationships.

3.4. Recruitment and data collection

The different configurations of digital mediations seeking to maintain social ties in nursing homes and examined in this study draw on data obtained within the framework of the Innovehpad study undertaken between April and October 2021. This was an interdisciplinary study of the psychological, social, managerial, health, and skill factors that influence the use of digital tools in maintaining social contact among nursing home residents. It was set up following the Covid crisis and the resulting changes in the organizational structure of these homes.

To consider fully the complexity involved in understanding the issues, conditions, and effects of the uses (or non-uses) of these digital tools, each member of the Innovehpad team (composed of researchers in clinical psychology, sociology, management sciences, ethology, and education) drew on their disciplinary knowledge to highlight a specific facet.

In this exploratory study, cases were selected if they corresponded to two requirements: representativeness and comparative reasoning. By "comparative," we mean the ability to *compare* one situation with another in order to highlight the possible specificities and invariants of "mediation work," based on singular cases that may later be grouped together into different observations and/or categories. Therefore, our comparative approach does not attempt to apply the same measurement across cases as this implies that the conditions of observation are always equal. It is less interested in replicating observations from a single case to reach a common understanding than in shedding light on the reality and *modes of existence* (Latour, 2012) of the digital tools that seek to maintain social ties in nursing homes. Depending on the levels of integration, comparing cases will then make it possible to identify clusters of the different experiences that give rise to the forms of use (or non-use) observed.

This article focuses specifically on how the association of clinical psychology, sociology, and management science disciplines makes it possible to describe the different configurations of digital mediation aimed at promoting social ties in nursing homes. It then opens the debate on how the psychological issues observed at individual, group, and institutional level may be understood. We visited seven nursing homes in France (including one dedicated to the educational sciences approach) and undertook 210 h of observation and 83 h of interviews. In the 89 interviews conducted, we met with 26 management head of nursing homes, 12 residents, 13 relatives, 36 professionals and 2 groups of professionals (*cf.* summary table of data collection in Supplementary Table 1 and interview guides in Supplementary Tables 2–4). The approaches in clinical psychology and sociology focused on nine mediation situations. Semi-structured interviews were conducted with residents whenever possible, and also with professionals and/or residents' relatives. The clinical psychology approach relied on semi-structured interviews aimed at assessing the unconscious representations and the psychological or emotional issues around the mediation proposed by these digital tools. The management science approach relied on interviews with nursing

home staff (management, executives, professionals in the field) and, whenever possible, with residents and their families.

3.5. Data analysis: a relational research method in an interdisciplinary context

These three disciplines sought not only to give a voice to the *actors* involved (residents, relatives, and professionals), but also to describe the *actants* likely to emerge, on whose behalf we would speak. "Actants," each with a "unique signature" (Latour, 1991, p. 118), refers to the "forms of existence that are involved in a course of action, […] to anything that modifies a given situation by introducing a difference into it" (Latour, 2006, p. 103). While *actors* can speak for themselves, Latour suggests that *actants* do not speak in their own voice: "Because they are mute; because they have been silenced; because, too noisy, they would become inaudible were they to all speak" (Latour, 1984, p. 245).

In this perspective, our work sought to make *visible* unconscious, social, and organizational phenomena by interpreting their characteristics, their modes of expression, and the conditions under which they are used or hindered by human behavior. To this end, we relied on case studies in which each researcher worked alongside the other researchers in the team to interpret data. Our epistemological approach, therefore, makes no attempt to be complementary (Devereux, 1972; Missonnier, 2016) or to highlight a multiple interpretation of the same object. Rather, it is closer to an "extended translation model," in line with the "sociology of translation" studies undertaken by Akrich et al. (2006). In this model, researchers adopt the position of a *mediator* of an object's reality, capable of speaking for the *actants*, giving them a voice in places where they would possibly have been voiceless without their help, without their skills and epistemological approach, without this "actor endowed with the capacity to translate what they transport, to redefine it, redeploy it, and also to betray" (Latour, 1991, p. 111).

Our team's conception of interdisciplinarity leads us to consider, and report on, "mediation" as a "hairy object," in the words of Latour, meaning an object with numerous attachments, associations, and affiliations. Ultimately, we seek to shift away from descriptions of the substances and properties of this phenomenon to consider "mediation" as a network. In this model, which is inspired by relational ontology (Slife, 2004), actors and objects exist only in relation to each other.

In no way does this choice aim to equate the concept of "mediation" to an axiomatic scheme, generalizing the multiple ways of understanding how the digital tools that seek to maintain older adults nursing home residents' social ties are experienced. Rather, it seeks to draw on what we believe to be its major theoretical contribution because of at least two essential qualities. First, we believe that it exceeds in promoting and analyzing the *dynamic perspective* in which we would like to incorporate the issues associated with digital tools aimed at promoting social relationships in nursing homes. Second, from a *transversal and relational perspective* – given that the concept of mediation tends both to challenge and to be challenged by different disciplines, notably psychology, sociology, and management sciences – it appears to be a "dialog magnet" between these disciplines, conducive to a reflective and collective production around dynamic issues, particularly individual, group, and institutional issues associated with the digital experience.

4. Results: an analysis of the different mediation configurations of the digital tools that sought to maintain social ties in nursing homes during the pandemic period

The results of the Innovehpad study show that the assistance provided to an older adult in a situation of dependency and separated from their relatives can only be "usable" if it meets certain conditions. On the one hand, the tools used must correspond sufficiently to the needs and desires of the individual, which means that they must be assessed before their introduction (based on individuals' expectations and on what they see as the tools' benefits) and afterwards (based on individuals' ability to embrace and use them to satisfy the needs or desires unexpressed until then). On the other hand, the approaches proposed must help individuals to embrace the tools proposed, and this undoubtedly requires some psychological work. Such an approach can make it possible to reduce the gap between residents' experience of the tools and their acquisition of subjective feelings of ownership of these tools. Lastly, given that these tools cannot be effective in themselves, the system must be able to rely on specific material and organizational arrangements. Special attention from the institution is thus required.

It is under these conditions, which are intricately linked, that one can examine the digital mediation approaches that seek to maintain social contact and to ensure that the older subject has a positive subjective experience, irrespective of whether this outcome is expressed by the subjects themselves, by their relatives, or by professionals. Our results show that the situations of "failure" – which often lead to abandonment – and the situations of "success" – which lead to regular or occasional use – cannot be attributed to weaknesses evaluated independently, whether physical, cognitive, psychological, or social weaknesses. To succeed in the mediating role, i.e., in mediating a sufficiently good relationship between residents and their loved ones, there is a need for more than merely efficient and ergonomic digital tools, and for more than just cognitive, sensory (particularly sight and hearing), and physical (visual-manual coordination) capacities: it requires specific organizational, interactional and psychological configurations.

4.1. Mediation configurations according to the organizational context of nursing homes

The attention paid to the different categories mentioned above calls for the identification of the different types of mediation possible based on the organizational context of nursing homes. Indeed, the organizational culture, the nature of the leadership, and the history of the organization all play a role in the development and evolution of organizations. This article analyzes the mediation proposed between residents and their relatives, which is provided by professionals and backed by the nursing home management. We identified three types of mediation which, while neither exclusive nor exhaustive, can be understood as ideal types.

4.1.1. "Fake mediation": professionals simulate ties with relatives

Nursing homes were put in the spotlight during the hyper-mediatization associated with the Covid-19 pandemic. Some of these homes experimented with mediation of the ties between residents and their loved ones in an attempt to manage risks. They proposed a stage setting showing what should be seen, with actors in front of screens and dialogs that were occasionally overheard, aimed at reassuring loved ones rather than at nurturing the ties of residents who had requested remote contact with their loved ones:

> Often, the tablets were more for the people, for families than for the residents here. They were supposed to reassure them, so that the relatives could say to themselves: "Well, they are not telling us lies, she's fine." I feel like this was the main function at the start. (Interview Nursing Home 6: Researcher in management sciences – C35, Woman, 50–55 years old, management head, living in rural area)

> It was good for the family, but not for the resident. Well, to reassure the family, but not the resident… He did not understand. At least not in the Alzheimer's unit. (Interview Nursing Home 6: Researcher in management sciences – C38, Woman, 25–30 years old, logistic officer, living in rural area)

In this context, while residents did not necessarily seek digital technologies, they could use them to facilitate the relationship with professionals, or to please or obey them. The question of freedom of choice thus arose:

Resident's daughter: Relationships on tablets? But she does not want it.

Interviewer: And yet she accepted them during the confinement period?

> Resident's daughter: Well, uh, yeah… Because she wasn't the one holding the tablet, it was the facilitator who was with her and who handled everything.
>
> (Interview Nursing Home 2: Psychology researcher – B14, Man, 60–65 years old, retired, former sports teacher, living in peri-urban area)

At the time, the managers of these establishments were concerned with legal or reputational issues: they sought to avoid complaints, to look good, to keep proof of interactions in case of incidences of geriatric cachexia, and to protect themselves from criticism. This type of technological mediation was therefore somewhat deceptive. It took place in environments in which only a few professionals were available to help the residents, with time constraints making it secondary to healthcare:

> We do not have the staff to really…let us call it, build ties. So it's true that there are many healthcare professionals who are a little frustrated and who tell me "but we only do… that's the only thing we do, it's non-stop work. (Interview Nursing Home 6: Researcher in management sciences – C36, Man, 35–40 years old, nurse coordinator, living in rural area)

4.1.2. "Humble attempt at mediation": professionals become the contact

Some nursing homes revolved around an "activist" or "humanist" approach and developed specific resources to establish projects that made it easier to listen to residents' needs and demands. Professionals were thus expected to take the necessary time to ensure the holistic support of residents. Irrespective of whether the objective was to rediscover a "family spirit" (nursing home n°6) or to adopt a gerontological approach inspired by the model of institutional psychotherapy (nursing home n°2), the heads of these homes set the stage for personalized, in-depth, and meticulous support which professionals provided.

One nursing home management head explained that digital mediation began when a family made an appointment, after which the resident was notified. He stated that:

> The professionals prepare, they warn the person, the resident, saying, for example: 'Mrs X, you have a Skype call in 15 min; are you still OK with that?' because, you know, sometimes there are people who are indisposed, who are... who aren't feeling well, so we try to assess the potential success of the encounter. (Interview Nursing Home 4: Researcher in management sciences – C33, Man, 35–40 years old, management head, living in urban area)

The facilitator then established contact and helped the residents who were unable to manage the video-call by themselves:

> One has to stay close by, explain to them what's going on: "Look, there's your daughter on the tablet, you can talk to her"; or try, for example when the resident does not hear very well, he'll say, she's asking you this, she's showing you a picture. (Interview Nursing Home 4: Researcher in management sciences – C33, Man, 35–40 years old, management head, living in urban area)

The mediation provided by professionals via digital technologies could then lead to genuine contact, to a close relationship between residents and their loved ones. Many professionals reported the visible satisfaction of residents during remote interactions:

> Many residents were happy to see their family via Skype. (Interview Nursing Home 1: Sociology researcher – A8, Woman, 80–85 years old, resident, living in peri-urban nursing home)

> When some residents see the faces of their daughters or their sons, everything changes immediately. The eyes light up, they are happy. Uh… Their joy is immediately visible. (Interview Nursing Home 1: Sociology researcher – A16, Woman, 45–50 years old, social life assistant 1, living in peri-urban area)

It was not always possible, or desirable, to put people into contact, and this was a fact that some professionals deplored, occasionally having to put an end to videoconferencing sessions:

For me, the objective is to maintain social contact, but if for 45 min you have the resident who remains stuck on their story about breakfast [unsatisfactory], and on the other side the girl who is completely desperate and who cannot talk to her mom, and the facilitator who's trying to guide the discussion, who's trying to explain

videoconferencing, look, there's your daughter, you can talk to her live, she'll answer you, etc., well, it's true that sometimes, for some, there could be... well, we do not achieve the objectives, in any case the objectives or the objective of social contact. (Interview Nursing Home 4: Researcher in management sciences – C33, Man, 35–40 years old, management head, living in urban area)

The professionals thus adapted to the situation to ensure that residents were comfortable.

In some cases, they were sufficiently independent to manage communication without the help of professionals, as one resident reported:

> We would see the images, first of the girls [the nursing assistants] and we would talk. The girls left and we were able to talk together [with her children]. [....] When you have Skype, you can talk about whatever you want because the girls leave and close the door. (Interview Nursing Home 1: Sociology researcher – A8, Woman, 80–85 years old, resident, living in peri-urban nursing home)

In other cases, the professionals had to stay, but this occasionally led to discomfort:

> Sometimes it bothers me to be there, because I tell myself that, because I'm around, they may not dare to talk about certain things. And at the same time, there is not much choice. Never has a family reproached me for staying… But it's me, it's how I feel. It's their moment, but there's still someone around. (Nursing Home 6: Researcher in management sciences – C37, Woman, 45–50 years old, social coordinator, living in rural area)

The tact necessary to ensure the success of this mediation was clearly expressed by one facilitator who spoke of the embarrassment that the present/absent place could cause when connecting residents with their loved ones.

In these contexts, the contact established via digital tools is nourishing for the residents. Although some of them fail, attempts to meet the residents' demands for contact are made by professionals. This approach, which revolves around residents' needs, requires the management to make changes in the organizational structure, notably with regard to an adequate pace of work and effective management which promotes professionals' work while respecting the older adults that they care for.

4.1.3. "Substitutive mediation": professionals as the link

Irrespective of the organizational structure, certain residents viewed the use of digital tools as too remote, too strange, or too disturbing:

> For them the internet is science fiction. (Interview Nursing Home 4: Researcher in management sciences – C34, Man, 35–40 years old, management head, living in urban area)

While the connection observed was real, important, and nourishing for the residents, it concerned residents and professionals, rather than residents and their loved ones. One facilitator spoke of the case of a resident who began speaking with her, rather than with her loved one who was present during a video call:

> She admires this technology […] every time she gets into a debate about it. She says: "Ah, it's a good system. And can we do this with everyone?" So she would stop listening to her daughter. (Interview Nursing Home 6: Researcher in management sciences – C37, Woman, 45–50 years old, social coordinator, living in rural area)

One psychologist also shared the case of a resident living in an Alzheimer's secure unit after contracting the disease relatively early. This resident used to walk with her daughter, sometimes in silence, leading to the establishment of a strong bond. However, this contact became impossible after the visitation restrictions. The psychologist established remote contact and then walked with the resident while holding the tablet in her hand. An important connection was thereby established with this professional.

This example was an important reminder that residents' social ties are embodied in their relationships with professionals, notably those professionals in the logistics department responsible for cleaning. During our observations, we noticed that these cleaners knew the residents, their habits, and their tastes quite well. During an immersion session, one of these cleaners accompanied us to a resident's room where the television was on. She then exclaimed:

> "But, Mrs. XX, are you watching TV? This is not the time that you normally watch. Do you want me to switch it off?." The resident, who was not listening to the program, agreed. This type of interaction involved a resident and a professional and was transposed, as mentioned above, in the case of digital mediations

In other words, when professionals simulated a link between residents and their relatives, digital mediations were "fake"; when these mediations made a genuine attempt to *establish contact,* a nurturing relationship could arise, and when *they were the contact*, the mediation was substitutive: contact was established between the residents and the professionals, rather than between the residents and their loved ones. These types of mediation relied on the existing organizational structure; indeed, the introduction of digital tools was not disruptive for organizations. On the contrary, it made it possible to reveal previously existing mechanisms.

4.2. Mediation configurations according to the interpersonal interaction approach

We observed several types of socio-technical mediations made possible when residents and their relatives were connected, with the professionals acting as intermediaries (Battentier and Kuipers, 2020) who guided the process while participating in the production of remote relationships.

4.2.1. The "one-way window"

In several situations, the mediation produced could be perceived as a "one-way window," meaning that, above all, it allowed relatives to reassure themselves as to the physical and mental state of residents, without the latter actually participating in the exchange. In this sense, for instance, a psychomotrician explained to us during an interview that:

> For the girl, it was really important to see her father. In fact, it was… I think it was really good, it's just that it was… Well, I was a little surprised at how hard he found it to embrace… to embrace this tool, whereas it seems super simple to me who is a millennial. I saw that it wasn't easy for him. [...] Actually maybe it was easier for him on the phone because he was more used to it, and when we switched to the tablet he was a little taken aback, he did not really know what to do. [But] it was better for his daughter, seeing him reassured her. (Exploratory interview: Sociology researcher – A4, Woman, 30–35 years old, psychomotor therapist, living in Paris)

4.2.2. The "counter window"

Ideally, the mediation proposed may be perceived as a "counter window," meaning that the residents and their loved ones were able to see and talk to each other without risking contamination. For example, during the interview, and following our request, one resident was quoted as follows:

> Interviewer: What I would like to know is what you talk about during video calls, does one experience the same thing as they do when they see each other?
>
> Resident: Yes, yes, for me, yes.
>
> Interviewer: You told me, for example, that when your daughter came, you would talk about the news. Do you do that too?
>
> Resident: Yes, we would, yes. We would talk about the news of the week. [Especially in relation to the Covid] since that was the main topic.
>
> (Interview Nursing Home 1: Sociology researcher – A9, Woman, 80–85 years old, resident 1, living in peri-urban nursing home)

In such a situation, professionals were essentially responsible for launching the videoconference call. They would then withdraw to promote the emergence of intra-family intimacy. However, the remote social contact thus produced was described as a degraded version of what real-life visits allowed. Indeed, the same resident said: "No, I prefer face-to-face however." She specified: "Because we see the person, it's much better." Even though videoconferencing makes it possible to "see," her discourse implied that this type of communication was a degraded version of the possibility of "seeing," that the physical body was missed.

4.2.3. From the "virtual smoke screen" to the "opaque counter window"

Depending on the different actors involved, videoconferences were perceived as "virtual smokescreens," as with the case of a resident and her son who were both frustrated with digital technology. She said:

I cannot get used to it, [...] because it irks me (Interview Nursing Home 2: Psychology researcher – B9, Woman, 90–95 years old, resident, living in peri-urban nursing home).

After two attempts, the son, a retired teacher who had fought against the use of digital tools by his students, told us that their telephone discussions were more than enough to allow him to "see [his] mother every day" (Interview Nursing Home 2: Sociology researcher – A32, Man, 60–65 years old, resident's son, living in peri-urban area, retired-former sports teacher). The mediation of the relationship via the telephone could then be considered as an "opaque counter window" which allows one to talk without an image interfering with the relationship. The son's slip of the tongue, when he specified that he was able to "see" his mother, is therefore significant. For this same resident, however, the mediation of the social relationship with her great-grandson via videoconferencing appeared to be a "counter window" in the sense that it was the only way to communicate with him as he was too young for a telephone call. The relationship therefore primarily involved gestures, with the child pointing to the resident and the latter waving.

4.3. Mediation configurations depending on the quality of the transitional space

Focusing on the unconscious dispositions mobilized and supported via digital tools also allows us to go beyond material, organizational, and interactional arrangements and to examine the intrapsychic and intersubjective processes that help individuals to embrace these tools. This is only possible if the tools are proposed and used within a transitional space developed via digital mediation. But, first, the environment must be made as accessible and as convenient as possible for the older dependent person and must allow transitions. The responses from the environment are thus the vectors of individuals' subjective experiences revealed during the mediation situation, and also powerful drivers of their transformation. When these responses offer an objectual support sustaining the construction of a potential transitional space, the device possibly becomes a shared co-creation between each actor involved, between the real and the imaginary, between the internal and the external worlds. Otherwise, it can be experienced as an attack on or imposition of objectively perceived external reality, or as a "subjective object" retained in the subject's sphere of omnipotence and acting as a set of projections disengaged from their perceptual roots.

4.3.1. "Playing the game"

The pleasure felt, expressed, or revealed in either speech or behavior is a valuable indicator of individuals' ability to function within this transitional space and of the quality of commitment to the technology, even in cases where they did not initially request the tool. Some people thus agree to "play the game," their desire revolving around that of their loved ones and/or the professionals. They discover a mutual interest in these situations, or even a shared pleasure in a sufficiently good relationship between residents, relatives, and professionals. The absence of pleasure is a common feature in the configurations described earlier, which function as "smokescreens of the virtual." Digital tools can only act as mediators if they are sufficiently *emotionally* invested in by residents, their families, and the professionals, and if their internal organization and the unconscious dispositions of the different actors make the connection between intrapsychic and intersubjective networks possible:

> A nurse thus spoke about how her rejection of digital technologies in her own daily personal life, and her feelings of incompetence, may have prevented her from committing to tools that she nonetheless perceived as being useful and important in enabling

> residents to maintain contact with their loved ones. She also said this may have led her to develop avoidance behaviors so as to avoid these digital tools. Beyond the obstacle of digital skills, the clinical interview revealed additional obstacles, relating this time to the feelings of rupture that the implementation of videoconferencing provoked among residents in need of individual support during this time. This rupture was in continuity with the care provided in the nursing home (mediation obliged professionals to leave the service and to join a space dedicated to videoconferencing, which the assistant viewed as unfair to all those who needed her during this moment, i.e., other residents and her colleagues). It also affected her previous relationship with this resident's family. She specified that she usually met many families by acting as a mediator for residents, meaning that she had discussions with visitors within the common spaces of the nursing home, or even in the corridors. There were often other residents and other families participating in discussions in the space where this professional was assigned: in the space–time continuum of the video-conference, in a special meeting with this resident's family, one filled with renewed intimacy, irrespective of whether she was called upon or whether she was merely a witness, a spectator to the discussions. This nurse voiced her discomfort in this paradoxical situation in which she felt like an included/excluded third party, and which tempted her to pry. The new structure no longer allowed the resident-relative-professional relationship to encounter the organizers who had previously provided a framework for a sufficiently good triangulation, and who particularly relied on the mediation provided by the institutional context and the presence of other residents, visitors, and professionals. (Interview Nursing Home 1: Psychology researcher – B7, Woman, 45–50 years old, nurse, living in peri-urban area)

This testimony clearly illustrates how digital technologies are based on both material and unconscious dispositions, the highlighting of the inaccessibility of some dispositions sometimes concealing the inaccessibility of others. Although insufficient, making an emotional commitment to video calls is essential for the success of this intermediate relationship resulting from the physical distance between, and the separation of, the interlocutors. Digital technologies can only act as mediators if they meet the conditions enabling the creation of an intermediate space capable of restoring the transitions between separate spaces (residents' living spaces / relatives' homes): if they make it possible to create continuity and provide the same quality as the previous relationship between residents and relatives and between relatives and professionals; and if they support the connection between residents' unconscious experiences and their external worlds, between the processes of projection and those of perception, called on to interpret the image and sound generated by videoconferencing.

In certain mediation frameworks, digital tools allow the creation of an additional real space which supports the psychological process of "presentification" (Haddouk and Missonnier, 2020), i.e., which makes it possible to re-establish a connection between one's awareness of unconscious processes and what one feels in one's body. This work is particularly undermined in neurodegenerative disorders, which explains why the professionals undertook this work only with residents suffering from moderate to severe cognitive disorders. Indeed, some professionals remained physically present during discussions between residents and relatives, under the pretext that this would enable them to be immediately available should a technical problem occur, and thus they positioned themselves as assistants. Others took on an auxiliary ego function, offering themselves as an "other," as a *loved one* ready to lend their body, their voice, their time, and their "psychic space" to support the illusion of continuity in this connected but separated long-distance relationship:

> This was the case with the "substitutive mediation" mentioned above, in which the professional walked with the resident whose reunion with her daughter had previously revolved around walks both within and outside the nursing home, and also occasionally sang along with her. During the Covid-19 confinement, the professional (psychologist) succeeded in making this digital tool usable – it had otherwise been inaccessible for this resident who had major cognitive disorders – by holding and carrying the tablet herself, moving with it from one place to another, and changing its position depending on the movements and initiatives of both the resident and her daughter. She also reformulated, or repeated, certain words, sounds, or melodies while relying on her observations to relate to the experiences of the resident and her daughter, as well as to the tone of the mother-daughter bond. The professional adjusted her intervention according to the effects of presence or absence that this aroused, in order to help rediscover or create the quality of the previous relationship between the resident and her relative. She focused on a mediation approach which borrowed from, and conveyed, an affective and sensory tone that quickly reinforced the relationship between past and present, and between visual and auditory perceptions and bodily experiences. (Interview Nursing Home 1: Psychology researcher – B3, Woman, 30–35 years old, psychologist, living in peri-urban area)

The professional's non-encroaching proximity thus ensured some form of continuity in the emotional, affective, and fantasy behavioral divide common between face-to-face and distance relationships (Haddouk and Missonnier, 2020). In addition to relying on her knowledge of the quality of the previous relationship between the resident and her relative, she also relied on a position ultimately less substitutional than that of a third-party, and one that was respectful of the distance required to ensure that the different spaces were maintained; this helped to structure this three-way relationship. This situation reflects the inventiveness and creativity that certain professionals and relatives managed to "find-create" (Winnicott, 1971) every day, often in an intuitive and spontaneous manner (according to the interviews we conducted), in order to give substance to the "presence of the absent," to allow the person to feel they were in the presence of someone who was actually distant. The frameworks that appeared to most favor residents' ability to assimilate this experience subjectively were those in which the digital tool – including the positioning adopted by the professional – was designed in such a way as to maintain the illusion of continuity (between oneself and the other, between what is perceived and what is projected by the image appearing on the tablet, etc.) – as well as the consubstantiality of the pleasant and unpleasant aspects of this experience – or to favor access to transitionality and ambivalence.

4.3.2. Disturbing strangeness

A minimal integration of contrasting instinctual drives directed toward the tool appeared essential to reduce the degree of surprise, the strangeness, and the anxiety occasionally aroused by the tool's effects, against a background of permanent change. Looking into the screen's mirror and discovering an image of someone other than oneself, thus breaking the illusion of completeness and limitlessness, may have led to wild interpretations from certain residents. This may have aroused a disturbing and intense strangeness around "that, within us, which must be set aside, rejected, disavowed or left unspoken, but is suddenly revived, not without displeasure" (Green, 2000, p. 177):

> For instance, one resident told us how, positioned in front of her reflection on the tablet's screen, she not only recognized herself as she was, but also had to face the perception of a body that irreducibly escapes attempts to master work around one's own death; in front of her reflection, she had to face an open breach in the manifestation of the temporal uncertainty of one's being.
>
> This mirror effect, which tore off the protective veil of the fantasy, awakened a castration anxiety so intense that repression was insufficient to contain the excitement and she was forced to remove herself from the perceptive field. This led her to withdraw from the digital project and subsequently to reject it. There seemed to have been no discussion between professional and resident to prepare the latter for this potential outcome and to co-construct some form of background allowing perception-projection processes to be played out in conditions offering subjective security, thus safeguarding residents' narcissistic continuity. (Interview Nursing Home 1: Psychology researcher – B2, Woman, 80–85 years old, resident, living in peri-urban nursing home).

Here, as well, the quality of the mediation provided by the professional played an important role in determining whether this experience took place in a context where doubts were sufficiently addressed. In this respect, most residents expressed the extent to which this experience could arouse contrasting emotions, particularly joy and sadness, especially when it was time to separate. Once again, the manner in which this separation took place depended on how professionals paid attention to this specific moment:

> For instance, the interviews undertaken with a facilitator highlighted how difficult it was to bear and embrace the "normal" sadness associated with this separation without excessive sentimentality or the triggering of manic defenses, which was behind the ideology of the "heroic professional" at the center of political and media attention. (Interview Nursing Home 1: Psychology researcher – B12, Woman, 45–50 years old, social coordinator, living in peri-urban area). Other professionals spoke of their encounter with the pain, even the distress, of certain residents in certain situations. These were when the screen became empty after the image of their relative disappeared when the tablet was switched off, when a loved one was sometimes barely recognized – especially when residents had cognitive disorders, for instance during early stages of dementia – or when they were recognized in a way that made residents feel they were experiencing a disturbing strangeness. (Interview Nursing Home 1: Psychology researcher – B3, Woman, 30–35 years old, psychologist, living in peri-urban area / Interview Nursing Home 1: Psychology researcher – B6, Woman, 30–35 years old, reception officer, living in peri-urban area)

4.3.3. Excess contact

Providing a facilitating environment, and allowing digital tools to provide a significant subjective experience for residents and relatives, requires one to address the ever-present temptation of excessive seduction or compassion and reassuring complicity. One must also avoid the occasional infantilization of the resident, which prevents use of the forcefulness required in the face of a substitute relationship while awaiting the lifting of visitation restrictions, a situation that is inevitably frustrating, disappointing, and unsatisfactory, in part at least. A facilitating environment also requires one to avoid overinvesting in gratitude (particularly expected from relatives) as recognition of a job well done, or of proven usefulness (see the "fake mediation" configuration proposed above), at the risk that recognition – which is essentially about *doing* (doing with, doing for) – becomes more operational, and that the psychoaffective stakes of the tie are denied. In some configurations, the tie appeared as inherent to the relationship rather than as an element that must ceaselessly be reactivated in the face of change; the digital tool was then proposed (sometimes imposed) without working on the connection first. This assumes a minimal investment and a necessary consent or assent (des Lefebvre Noettes, 2018) from the residents. This concern is not only an ethical *praxis*, but also requires a clinical appreciation of the motivations and effects of this commitment. We thus focused on how the implementation of videoconferencing tools has occasionally relied on excessive anxiety, where seeking the good of others has led to a focus on incapacities and to the imposition of several constraints (even relational) in the name of "care." Certain residents' attitudes of refusal, submission, or disinterest show the extent to which seeking the good of the other is not sufficient for the other to accept consideration toward them, to find it meaningful, or to express themselves, even via a refusal not overly tainted by guilt:

> For instance, a resident expressed her annoyance at what she perceived as an "order to connect" via videoconferencing, which she viewed as "excessive contact" compared with her previous relationships with her relatives. This excessiveness prevented the implementation and adoption of a serenely consented passivity which would have allowed her to develop a bordered and fertile hollow in which to take refuge, in support of *suspension* rather than *inertia*, and aspiring to the elimination of agitation, torment, and suffering. (Interview Nursing Home 2: Psychology researcher – B10, Woman, 90–95 years old, resident, living in peri-urban nursing home)

Some residents appeared to remain as they always had been throughout the duration of confinement, as though protected from the surrounding anxiety-provoking environment and the conflicting issues of the common solicitations that habitually increased – particularly in nursing homes – an ideal of autonomy in terms of activity and movement, and which were now turned toward

protection, with the confined spaces of their bedrooms perceived as the safest spaces.

The systematic use of video calls in certain nursing homes – irrespective of whether or not these tools were aimed at acting as mediators to help residents to maintain their relationships – appeared to be an attempt to offer loved ones an object that was always accessible and was quick to hear, to respond, to reassure (sometimes by showing reassurance), or to relay, in a massive counter-cathexis of absence commensurate with major separation anxieties and their deadly echoes, particularly in geriatric facilities. In many respects, the proposal of "contact at all costs," occasionally overinvested in by professionals, seemed to be in response to the perceptions, sometimes unstated, of renewed castration anxiety, passivity, and even death among residents, their relatives, and also themselves. In this context, the interviews highlighted the extent to which some professionals found it difficult to respect residents' defensive behaviors, some of which involved withdrawing investment, opposition, and refusal. In these situations, some professionals may have had difficulty maintaining the quality of a relationship that was not excessively demanding. Some also had difficulty in sustaining an investment that was experienced less in the quantity of presence or in "doing" than in the realization of a presence/absence background that tested the question of the *reliability* of the objects to be invested. These individual, group, and institutional difficulties draw attention to the psychological, relational, and organizational conditions required to ensure that the mediating potential of digital tools, aimed at maintaining social ties in nursing homes, does not disappear through the effects of subjectively perceiving activism as an infringement that does not allow individuals to give meaning to what is experienced, acted on, felt, desired, or refused.

5. Discussion: from inequalities in the adoption of digital tools aimed at maintaining social ties in nursing homes to misunderstood demands

5.1. Digital technology: a "non-neutral" intermediary

The Innovehpad research built on studies that emphasize the need for a shift from analyzing the relevance of technological tools to an analysis of how these tools are proposed and used (Wu et al., 2011; Sharkey and Sharkey, 2012). Several studies, such as those undertaken in the philosophy of technology by P. Verbeek (2005, 2009), have attempted to highlight the social and cultural role of technology, as well as the ethical and anthropological aspects of the relationship between human beings and technology. A similar question, which clinical psychologists have addressed from the angle of the "non-human environment," has aroused less enthusiasm in this community, even though previous studies by H. Searles (1960) attempted to analyze how this environment affected the unconscious. However, as Missonnier argues, "scotomization is significant because not only are the representations supported by the common technical objects that they produce, but they are simultaneously sculpted in return by their customary relationships with them" (Missonnier, 2009, p. 232). Indeed, these technological tools are much more than silent and passive objects used only as instruments, or as a narcissistic extension of the user's capacities; they affect individuals from whom they expect a reaction. While the Covid-19 pandemic has forced many countries to pay attention to e-health and to remote devices, it has also made it possible to increase the call for studies in the clinical psychology and psychopathology of digital relationships, a field in which few or no studies have been undertaken. Clinical psychologists working in this field have essentially focused on analyzing the psychic processes associated with certain therapeutic tools such as digital mediations via video games (Gillet, 2018; Haza, 2019; Gillet and Jung, 2022; Haza and Hung, 2022; Tisseron and Tordo, 2022). Others studies have analyzed the uses of digital technology, undertaken a psycho(patho)logy of our daily virtual reality (Tisseron, 2012; Vlachopoulou and Missonnier, 2019). More recent studies reflected on the potential and the particularities of digital psychological assessment (Bravermann and Vlachopoulou, 2023).

However, the manner in which older subjects relate to digital technology has received little interest from clinical psychology, despite the fact that this would allow a better understanding of the specific unconscious mechanisms mobilized when digital tools are proposed to older adults, their relatives, and professionals in nursing homes. While there have been passionate debates around these questions, there is still no clear distinction between technophiles and technophobes.

The findings of our study are consistent with recent studies pointing out that, while digital tools transform professional practices, they also lead to some form of ambivalence associated in particular with the introduction of digital tools in the relationship of care and in nursing homes (Gaglio, 2018; Dussuet et al., 2022). In addition, we found that no professional had received training in the use of these technical tools, through activities focused on the relationship dimension. Professionals used their everyday experiences to set up "experimental" approaches that were based on improvisation and creativity, and they also relied occasionally on inter-professional mutual aid to promote the development of certain skills. This availability was, however, largely restricted by the heavy workload associated with the well-known difficult working conditions in nursing homes, which became even more difficult during the pandemic. The study, however, shows how training must go beyond technical issues and must pay attention to deepening the relational issues that have emerged alongside these new digital technologies. The report on the ethical and legal issues of the use of digital technologies among older people, commissioned by the Silver Economy Sector (Brugère and Gzil, 2019), also highlights the need to go further with regard to certain ethical concepts and certain rules relating to rights and freedoms, notably in relation to changes in the legal framework of professional secrecy and information-sharing.

At a time when the material conditions of care, and the intermediate spaces (Gaillard, 2017) within these institutions, are greatly threatened and at risk of exclusion, technological tools may become symbolic of the expression of a "malaise in care," provoking tension between the mandate of care and the mandate of protection entrusted to these institutions. Numerous aspects for or against autonomy, experienced in a situation of dependency, are therefore likely to permeate the encounter when videoconferencing is used, and these may or may not provoke conflict, depending on whether nursing homes are willing and able to develop the capacity for containment and transformation. For healthcare providers, this *care* (within which videoconferencing falls) must itself be addressed.

This raises questions about the institution's *desire* to reduce the constraints weighing on the subjectivity of and crushing professionals' psychic temporality – making it possible to subvert technological tools – and to situate the different actors and actants as objects capable of acting as mediators rather than as neutral intermediaries. Metabolization, or even psychoanalytic elaboration, can then be undertaken, individually and as a team, to mobilize the individual and collective resources that increase the chances of success. These resources must be able to bring transitionality into play and to integrate contrasting instinctual drives within a conflict of ambivalence which affects, as some of our results show, the investment in these digital tools. The identification of these two drivers, ambivalence and transitionality, is extremely valuable in helping one to acknowledge the experience of separation that inevitably induces discontinuity. However, this is a bearable discontinuity insofar as the illusion of continuity can be maintained within the transitional space, notably by supporting symbolization processes, the quality of which future research should clarify. These drivers allow the constituent objects of the technological tool, recognized in their radical otherness and foreignness, to promote the satisfaction of instincts, but they also become an unending source of frustration. This perspective is in accordance with the function of the *pharmakon* screen (Vlachopoulou and Missonnier, 2019) – remedy and poison – in which the digital object leads to strong ambivalence and is experienced as both useful and dangerous for relationships, as both nourishing and toxic.

5.2. The misunderstandings of the videoconferencing request

Under favorable conditions, the material and psychic provisions that the tool combines make it possible to develop an intermediate space of experience, one which opens up a potential transitional space characterized by the fact that it belongs to both the real world and the fantasy world, to both external reality (material and environmental) and internal (psychic) reality. In other words, making use of transitionality notably involves promoting and committing to a space of illusion, a space of all potentialities, in which the question of "who does what," or "who wants what," is not directly asked. In this regard, when the residents were questioned directly on their request for videoconferencing, very few expressed – when they remembered engaging in this experience – a commitment to this tool or a "desire to use it." While several residents struggled to explain the reasons for their refusal or reluctance, others mentioned some form of coercion, the desire coming from a stronger other, on whom one depended. The latter therefore accepted the proposals for fear of retaliation or of being abandoned.

This calls for particular attention to be paid to how residents' requests (or non-requests) are received, heard, or possibly transformed, in order to identify whether, behind the manifest behaviors and discourse, lies a latent request that may be struggling to express itself. The complexity of this request may be explained by the fact that it lies at the crossroads of needs and desires and is associated with an anxiety that shapes the differentiated satisfaction of instincts, resulting in narcissistic – or objectual – and specific and singular investments in the object. Thus, the manifestation or expression of a resident's complaint of loneliness ("I feel alone") may have been interpreted by relatives and/or professionals as the expression of a need or desire for contact. This interpretation, in which the projections from one's entourage are woven, may have given rise to the proposal to connect with loved ones via videoconferencing.

Such a response, however, can be understood as a defensive mode of addressing guilt and anxiety among relatives and/or professionals, in response to the anxieties of castration, abandonment, or even death among the older adults, which were undoubtedly heightened during the confinement and health threats, but which are already central to the unconscious issues associated with dependency and institutionalization as one ages. When these anxieties are not worked out, the decision to set up videoconferencing, with its underlying defensive objective, reveals some form of "mirror functioning" in which professionals mirror the older subjects with whom they work, in line with the "*functional homology*" (Pinel, 1996) phenomenon. By mirroring the anxiety of the older subject (or that of their loved one), videoconferencing, while seeking to produce a positive effect, risks displacing and increasing the effects of the "negative" of dependency, which may worsen individuals' issues within nursing homes.

5.3. The different configurations aimed at using digital tools to promote social ties: an indicator of how the "work of the negative" of aging and dependence is addressed in nursing homes

We believe that the situations in which older adults nursing home residents rarely participate in decisions about setting up videoconferencing sessions, or in which their voices are rarely heard, reveal how dependency shapes the relationship between the different actors, or more precisely, shapes the myths and representations around addiction that structure the relationships between different actors. Participation in decision-making can take different forms and can range from initiating a request to expressing consent or satisfaction (even in cases where there is still some ambivalence). This issue seems essential for a better description of how these tools can help to promote a "positive" subjective experience for older adults residents. It must be said that this positive valence is closely linked to actors' representations and aims when they start using this tool and is also connected to the theory of care that underlies professionals' actions: does this positivity help to promote residents' well-being, their pleasure, and their autonomy? Does it compensate for their incapacities or help them to express their unconscious mind?

The different ways in which the digital tools aimed at the maintenance of social ties in nursing homes are used thus shed light on the ways in which residents' requests to engage/be engaged in this proposal are considered. The situations in which the request was not considered, or in which consent was not sought, thus raise the question of the strong heteronomy in these institutions, when dependency and autonomy are opposed back-to-back, which is occasionally hidden behind all the best reasons for providing care. They also raise the question of how the relationship between residents, families, and professionals is structured and incessantly

plays out as soon as the older adults joins the nursing home. Digital tools can only act as mediators if the relationships between residents, their relatives, and professionals are organized around a "good enough" structure comprising three parties. There must also be mutual support between the family group and the group of professionals, the latter also depending on the support of the institutional system. This condition requires the adoption of changes by the institution and by the professionals, notably regarding their ability to offer spaces for transformation that allow the "nesting of frameworks" (Kaës, 1987), and of family and institutional frameworks in particular. This support can be compromised by the psychic conflict arising from the "horizontal tension" between the various members of the family and the professional entourage, on the one hand, and the "vertical tension" produced by the relational dynamics between residents and relatives, on the other. As the results show, the objective of videoconferencing can then become counterphobic, i.e., aimed at reassuring feelings of guilt and fantasies of abandonment and mistreatment, but also at proposing some form of control via the visual, or the scopic.

In these configurations, the initial aim of "social contact" seems relatively present in reality compared with what was initially laid down or expected. Our study thus shows the extent to which the feasibility of setting up digital technologies may prevail over the question of the legitimacy of social contacts, thus overlooking the following essential questions. Is social contact desired? Are all residents capable of finding, creating, and committing to social ties? How does each individual define "social contact," or perhaps a privileged moment spent in the presence of the other whose otherness is not always acknowledged but whose presence awakens emotions and feelings of pleasure, of being alive, of being in a safe space, even if under the constraints associated with Covid-19 confinement or with the digital tool that is viewed as unwanted, unpleasant, complicated, frustrating, or disappointing?

6. Conclusion

The results of the Innovehpad research show that videoconferencing tools, while non-invasive in a physical sense, cannot claim to be neutral in a psychological sense: the technologies that attempt to act as mediators in maintaining or developing the possibilities of social contact between older adults nursing home residents and their relatives are neither simple nor are they neutral everyday objects. The gap between the recommended uses and the real uses (taking into account how these approaches were developed and embraced) gives rise to various configurations in which the tools' mediating capacity is not a given but must be continuously (re-)created and (re-) established to enable the creation of a transitional relational field in the presence of the mediating object. This is essential to prevent studies of inequalities in the adoption of digital tools adopting a "*bio-social shunt*," meaning the temptation to eliminate references to the unconscious by squeezing the latter between data borrowed from the fields of biology or physics and from socio-anthropological inspirations (Green, 1991, 175), in accordance with researchers' interdisciplinary projects. The contributions of the research also seem to us to be essential to support the reflection, within nursing homes, on the different modalities of use of the digital technology and their effects, in order to allow the professionals to accompany the use of these technological devices in an aim which favors their subjective and positive appropriation by the older adults.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by the Research Ethics Committee of the University of Strasbourg, Strasbourg, France (accreditation number: Unistra/CER/2021–10). The patients/participants provided their written informed consent to participate in this study.

Author contributions

CR participated in the conduct of the research, coordinated the writing of the manuscript, and drafted the psychological contributions to the manuscript. RM contributed to the analysis of the data, the discussion of the results, and the writing of the manuscript. CH was involved in conducting the research, analyzing the research results, and writing the manuscript. VB, FC, and CS participated in conducting the research and finalizing the manuscript. CL led the research, participated in conducting the research, in the analysis of the research results, and in the writing of the manuscript. All authors listed have made a substantial and intellectual contribution to the work, and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1154657/full#supplementary-material

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Learning digital skills online: empowering older adults through one-to-one, online digital training provision

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Introduction: Digital exclusion, through lack of access and poor digital skills, can have an adverse impact on daily living. Not only did the COVID-19 pandemic dramatically impact the necessity of technology in our daily lives, but also reduced the availability of digital skills programmes. This study aimed to explore perceived facilitators and barriers of a digital skills programme that was delivered remotely (online) and to reflect on this form of training as a possible alternative to traditional face-to-face models.

Methods: Individual interviews were carried out with programme participants and the programme instructor.

Results: Two themes were generated from this data: (a) Creating a unique learning environment; and (b) Encouraging further learning.

Discussion: Barriers to digital delivery were evident, however, the individual and personalized delivery empowered participants within their own learning, supporting individuals to learn skills relevant to them and to continue their digital learning journey.

KEYWORDS

digital, critical geragogy, older adult, skill building, digital skill development, facilitators, barriers, training

Introduction

The COVID-19 pandemic heightened the ubiquity of online participation across our society. Individuals changed their ways of working, teaching and learning n, communicating with one another, and ways of accessing services such as banking (Martin, 2020), booking GP appointments (Clarke et al., 2020), and participating in online exercise classes (Wilson-Menzfeld et al., 2022), to name but a few. Not everyone was able to ride the digital wave and navigate this rapid shift, and this "digital divide" resulted in a radical increase in inequalities across the UK and internationally (Bower et al., 2021). Inequity of digital use comprises multiple levels; access (including access to the internet and other material access, for example, digital devices) (Van Deursen and Van Dijk, 2019); digital skills; and not recognizing the benefits of using the internet (Van Deursen and Helsper, 2015).

Although pandemic restrictions have eased across the globe, many services remain online, maintaining inequities for those who remain offline and digitally excluded. While acknowledging the lack of evidence in this area, Honeyman et al. (2020) theorized that digital exclusion could influence health inequalities directly; i.e., the inability to access digital-based health improving services or resources, and indirectly; limited access to wider

determinants of health, such as housing and benefits prospects which are offered through digital means. Consequently, this impacts the individual's behavior and leads to unmet need, which in turn can negatively impact health and wellbeing. It is critical that digital transformations, including, digital health transformations, must be designed with health equity at the forefront (Kickbusch et al., 2021; Van Kessel et al., 2022a).

Inequalities throughout the life course increase the risk of digital exclusion in later life (Wilson-Menzfeld and Brittain, 2022). However, while there has been a rise in internet use from those over 75 in the last decade (Eurostat, 2017; Office for National Statistics [ONS], 2018), older adults still use the internet to a lesser extent than younger generations and are more likely to be considered 'digitally excluded' (Age UK, 2018). For instance, in a recent exploratory analysis of Eurostat data, Van Kessel et al. (2022b) reported that only 7.87% of adults aged between 65 and 74 years old reported above basic digital skills compared to 60.35% of those aged 16–24 years old. The presence of digital skills for older adults is critical to improving digital inclusion. Aging has generally been considered as a social construct, with perceptions being influenced by culture, societal expectations, and individual experiences (Chonody and Teater, 2016). NHS England (n.d.) generally consider someone over the age of 65 to be an older person. Traditionally, in the UK, 65 years of age was the official retirement age for men and the age they could utilize their State Pension, therefore this long has been used as a threshold for older age (Office for National Statistics [ONS], 2019). However, due to changes to working patterns, changes to the official retirement age and people living longer lives, the threshold of considering someone 65 years of age an older adult may soon begin to shift (Office for National Statistics [ONS], 2019). For the purposes of this paper, the definition of older adults being 65 years and older, used by NHS England, is followed.

The development of skills in later life, including digital skills, can be both fulfilling and empowering (Withnall, 2009). Geragogy, and Critical Geragogy, is a distinct part of Pedagogy, a learning theory focused on learning in later life (Formosa, 2002, 2011, 2012; Findsen and Formosa, 2012). Rather than focusing on the psychological deficit model, Geragogy and Critical Geragogy recognize older adults' distinct physical, emotional, and social learning needs, and aims to empower learners through self-directed and self-led learning (Lebel, 1978; Formosa, 2002; Wright and Wright, 2016). A recent systematic narrative review examined the role of Geragogy and Critical Geragogy in the delivery of digital skills programmes for middle and older age adults (Gates and Wilson-Menzfeld, 2022). Whilst only one of the 17 papers explicitly referred to learning theory, the review highlighted the importance of three intersecting components that impact digital skills training for older adult; negative perceptions of aging, the learning environment, and the value of technology (Braun and Clarke, 2006; Gates and Wilson-Menzfeld, 2022; **Figure 1**).

Self-efficacy can impact the learning process and the development of new skills. The learner's perception of their own abilities and capabilities can influence motivation to complete learning-based tasks, effort placed in learning, as well as the likelihood to continue in the event of obstacles (Bandura, 1977, 1982). Self-fulfilling prophecy, in contrast, incorporates and acknowledges the influence of the teacher's expectations of the learner's abilities on their development and academic behaviors

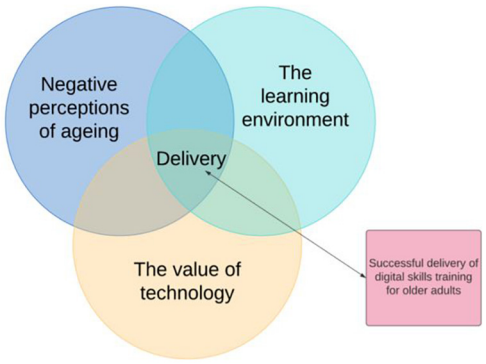

FIGURE 1
Theoretical model highlighting components for a successful delivery of digital skills to older adults (Wilson-Menzfeld et al., 2021; Gates and Wilson-Menzfeld, 2022).

(Jussim, 1986). Digital skills can be impaired by both self-efficacy and self-fulfilling prophecy. Self-efficacy judgments are impacted by prior internet experience, internet use, and outcome expectancies (Eastin and LaRose, 2000) and an individual's internet efficacy impacts willingness to use digital services (Tetri and Juujärvi, 2022). Furthermore, existing aging stereotypes toward older adults' digital and internet use can exacerbate an individual's own feelings toward technology use (Comunello et al., 2022).

Gates and Wilson-Menzfeld (2022)'s systematic review highlighted that older adults often hold negative perceptions of their own aging and demonstrated how this impacted learning digital skills. This aging stereotype must be challenged when initiating digital learning programmes through the promotion of individual learning styles and reflexive learning. Facilitating empowerment through the learning environment was important to support digital skills training. This involved the recognition of distinct needs, building rapport with learners in a safe space, and ensuring delivery aligned with learner expectations and needs. Finally, an individual's own needs must be central to learning through personalization; this required continual check-ins and reflection. Taken together, these factors can improve the implementation and outcomes of digital skills programmes, improving sustainability of programmes over time. It is fundamental that learning theories, such as Critical Geragogy, are embedded in digital skills programmes to remove the misconception that '*any type of learning will do*' (Gates and Wilson-Menzfeld, 2022).

The War Widows' Association (WWA) is a registered charity with 1,941 members (as of November 2021). To be a full member, an individual must receive/have received a War Widows' Pension or Armed Forces Compensation Scheme 2005 payments. Any individual interested in the welfare of War Widow(er)s or in supporting the aims of the WWA can become an associate member. The WWA recognized issues of loneliness and social isolation across their membership, along with the desire of members to be connected to other members throughout the UK, Working with (Institution), the WWA designed a digital intervention, the War Widows InTouch (WW.it) programme, to address these needs and to connect older war widow(er)s (over 65 years old) at both a national and local level (Braun and Clarke, 2006). The

WW.it programme also aimed to increase digital access, digital confidence, and digital skills, as well as reducing fear and the impact of aging stereotypes on digital learning. Utilizing Critical Geragogy as an underpinning learning theory, WW.it aimed to provide a personalized intervention which encouraged older war widows to take an active role in digital skills training, working collaboratively with the instructor throughout (Braun and Clarke, 2006). To accomplish this, members of the WWA were given iPads and/or iPad training (Braun and Clarke, 2006). This project took lessons from "Project Semaphore" which was carried out by the Royal Naval Association and had similar project aims (Royal Naval Association, n.d.). However, due to the COVID-19 pandemic, the implementation and running of the WW.it programme changed significantly. Initially the programme was intended to be completed face-to-face, and in a group setting, but was ran remotely, online, and in a one-to-one setting. This training model allowed individuals to receive digital skills training at a time when the use of technology was being perceived as a fundamental part of everyday life. However, this is a very different model of training than had been previously considered.

Due to the unique mode of digital skills delivery of the WW.it programme, this study aimed to explore the perceived facilitators and barriers of the WW.it online digital skills programme from the perspective of both the instructor and participants. In doing so, this study aims to reflect on this form of training (i.e., remote, online, one-to-one training) as a possible alternative to traditional face-to-face models.

Materials and methods

Design

This study is part of a larger, two-phase project which involved a mixed-method explanatory sequential design (Creswell et al., 2011). Mixed methods designs are typically chosen for evaluation studies to assess the impact of a programme, whilst also providing an in-depth view of the participant experiences to provide a more complete picture (Creswell and Clark, 2017). This mixed methods design, underpinned by Pragmatism (Feilzer, 2010; Morgan, 2014), allowed the research team to identify the self-reported impact of the WW.it programme, whilst gathering in-depth information regarding the implementation (see Braun and Clarke, 2006 for full evaluation). This paper will focus on the data collected as part of semi-structured interviews across both Phase One and Phase Two only. Quantitative analysis from this mixed methods study is presented elsewhere (Wilson-Menzfeld et al., 2021). Ethical approval was received from (institution)'s ethical approval system (ref: 120.3305). This study adhered to the UK Government's COVID-19 rules and [institution]'s guidance on social distancing and completing face-to-face research.

Participants

The WWA supported recruitment of their members into the WW.it programme through advertisement in an Association newsletter which is regularly mailed to all members. Those interested in taking part in the WW.it programme responded directly to the advertisement. Recipients of the WW.it programme were then invited to take part in the evaluation study. Participation in the research evaluation was voluntary and did not impact selection onto the WW.it programme (i.e., receipt of iPads and/or training).

To participate in the evaluation, participants needed to be members, or associate members, of the WWA and be aged 65 years or above. There were no other eligibility requirements for the study. All of the participants were female due to the membership demographics at the WWA being predominately female. No specific criteria for digital skills was taken. Participants were recruited from across the UK. A purposive recruitment approach was taken to increase inclusion of demographics such as age, location, previous military service, and length of time as a member of the WWA.

Seventeen participants chose to participate in semi-structured interviews in Phase one. Twelve of the same cohort also completed semi-structured interviews at Phase two (**Table 1**).

Phase two also involved an interview with the instructor who delivered this project and the iPad training ($N = 1$).

The WW.it programme

The WW.it programme was a personalized, remote, one-to-one digital skill building programme, featuring access to an individual instructor over the phone and via Zoom. Participants in the WW.it

TABLE 1 Participant characteristics in phase one and phase two interviews*.

	Phase one ($n = 17$)	Phase two ($n = 12$)
Age	66–90 years (Mean = 78.24, SD = 7.28)	66–90 years old (Mean = 77.75, SD = 7.65)
Location	Greater London (18%)	Greater London (17%)
	Northern England (24%)	Northern England (33%)
	Mid England (12%)	Mid England (8%)
	Southern England (35%)	Southern England (33%)
	Scotland (6%)	Scotland (8%)
	Northern Ireland (6%)	Northern Ireland (33%)
Marital status	Married, civil partnership or co-habiting (18%)	Married, civil partnership or co-habiting (25%)
	Widowed (77%)	Widowed (75%)
Children	Yes (82%)	Yes (83%)
	No (18%)	No (17%)
Living status	Lived alone (76%)	Lived alone (67%)
	Lived with others (24%)	Lived with others (33%)
Occupation	Retired (33%)	Retired (33%)
	Employed part-time (13%)	Employed part-time (25%)
	Unpaid/voluntary work (31%)	Unpaid/voluntary work (33%)
	Unemployed/not currently looking for work (15%)	Unemployed/not currently looking for work (8%)

*Those options which equated to 0% are not shown.

programme had access to support from the instructor throughout project duration (1 year) and 6 months following its conclusion.

From the onset, it was clear that participants held limited experience or knowledge of digital applications, therefore the WW.it programme was adjusted according to their individual learning needs, prior digital knowledge, and motivations for joining the programme, which was assessed in the early sessions. As a result, content was personalized to each individual. Despite this, topics relating to turning on the device, using apps, taking photos and online security and safety were covered with all participants.

Initially, the WW.it programme was going to be completed in-person and via UK-based Apple stores. However, following the COVID-19 pandemic and UK nationwide lockdowns resulting in temporary business closures, this was moved to a fully remote one-to-one training session with a sole instructor. Group training was not possible due to difficulty supporting multiple participants to join the video call, particularly due to their limited baseline digital skills. The role of the instructor was not initially intended to provide the training and therefore did not undergo specific IT training themselves. Despite this, their IT experience and competency as a lifelong Apple user was assessed as sufficient during the interview for the role, particularly regarding the participant's baseline digital knowledge. Additionally, coming from the military bereaved population themselves provided them with a shared understanding with the participants and the ability to quickly build rapport.

Materials

A semi-structured interview schedule was developed using the findings from a systematic narrative review conducted by some members of the research team (Gates and Wilson-Menzfeld, 2022) and from findings of the survey (as part of the wider mixed methods study; Wilson-Menzfeld et al., 2021). Contents of the survey included: demographic information; information about their membership to the WWA and other organizations; use of and attitudes toward technology; current social connections; and the impact of COVID-19 on their social connections and technology use. The survey responses also allowed personalization of the interview schedule for each participant.

While the systematic review findings and the survey results guided these conversations, the interviews were semi-structured in nature and remained flexible in reaching the goal of understanding how participants use technology and how they would benefit from the WW.it programme. The Phase One interview guide incorporated the concepts of value, underlying aims of participating in the WW.it programme, as well as feelings toward technology. The Phase Two interview guide also prompted discussion of negative perceptions of aging and the learning environment having completed the WW.it programme.

Procedure

Individuals who had volunteered to join the WW.it programme were invited to participate in the evaluation. Those who wished to participate were contacted the research team and a consent form was posted to them. They were able to opt into taking part in a semi-structured virtual or telephone interview by providing contact details to the research team. A member of the research team (JRG/AJ/GWM/MM) contacted participants to complete the interview. Interviews were completed prior to (Phase one) and following receipt of (Phase two) the iPad/iPad training. Interviews ranged from 15 to 60 min[1], were audio recorded and transcribed anonymously.

Data analysis

Data was analysed using Braun and Clarke's reflexive, inductive Thematic Analysis (Braun and Clarke, 2006, 2013, 2019), facilitated by The NVIVO 12 software package. Whilst not atheoretical, a key strength of Thematic Analysis is that it's not aligned with a specific methodology or philosophical underpinning, demonstrating suitability for the pragmatic approach used within this wider project (Braun and Clarke, 2006).

Noting that authors tend to assume Thematic Analysis as a singular method, Braun and Clarke (2021) present their work as a "family of methods," not as a "recipe" (Braun et al., 2022), comprised of similarities but key differences relating to coding methods, developing themes and conceptualizing results. One of these approaches is reflexive Thematic Analysis which is suitable for experiential epistemologies, and inductive analytic processes, as is carried out in this study (Braun and Clarke, 2021). Utilizing reflexive Thematic Analysis, this study analysed data using interpretative, reflexive processes (Braun and Clarke, 2021). Whilst using Critical Geragogy as a lens to develop the programme itself, data was analysed inductively, from the "bottom up" without a coding framework, before being abstracted and considered through its relationship to this learning theory.

A key component of reflexivity is acknowledging the role of the researcher, and the influence their positionality and philosophical underpinnings on the data analysis. Ravitch and Riggan (2012) outline the influence of the researcher's personal experiences, previous literature, and theoretical and ontological frameworks on developing research questions. Within this study, two members of the research team have lived experiences of military bereavement and therefore brought their own personal perspective to this study. This prior experience guided the research development and facilitated building rapport with the participants.

Braun and Clarke (2006) suggest six stages to facilitate Thematic Analysis: data familiarization, generating initial codes, creating themes, reviewing themes, defining and naming themes, and producing the final product. These stages were used as a tool to help guide the process of Thematic Analysis. In this case, members of the research team read and re-read the transcripts and after familiarization, used the NVIVO software to highlight potentially relevant or interesting quotes. In addition to highlighting quotes, the research team (GWM/JRG) left annotations throughout, as to the reasoning why they believed the quote to be relevant or

1 There are several possible explanations for the variation in interview times. For instance, this is likely due to prior limited knowledge of digital technology and what to expect from participating in the WW.it programme (explored in Phase One interviews). Additionally, it is likely that the participants were experiencing high levels of loneliness and social isolation, particularly as most of these interviews took place during the COVID-19 pandemic and, given the age of these participants, they were considered an at risk group and recommended to self-isolate.

interesting. These initial annotations then formed the basis of inductively generating the initial codes. These initial codes were then grouped together into categories to create initial themes. At first these categories were highly descriptive, however, upon review, the themes became more conceptual. The research team then discussed these different concepts, and finally decided upon definitions and names for the developing themes. Throughout this process, there was considerable movement back and forth between phases to generate the final themes.

Results

Two themes were generated from the data: Creating a unique learning environment; and encouraging further learning (Table 2). Each theme is made up of multiple sub-themes.

It is important to consider the group's previous experiences with digital technology to contextualize these findings. The vast majority of the cohort had very little, or no, prior experience using digital technology, including the iPad.

> *"I will start by saying my answer is a little bit restricted because in all honesty I don't know what you can do with an iPad [. . .] Once, if you like, I am a bit more aware of what you can do with it, I am assuming that more possibilities will suddenly become available" (P016, Age 79).*

> *"Being shown what it can do, probably that I don't even know what it can do. . .I haven't even thought about some things probably" (P023, Age 71).*

This impacted their expectations of using digital technology and the level of digital training provided.

Creating a unique learning environment

Personalization

Whilst not all online learning environments lend themselves to personalization, the personalized approach adopted by the WW.it programme was perceived as being central to its success. The WW.it training sessions were initially intended to be run as group sessions, however, due to the COVID-19 pandemic, all sessions were completed as remote, one-on-one sessions (unless another family member was present).

This personalization began at initial sign up to the programme. The instructor spent time speaking to each individual and developing a relationship. In doing so, the instructor was able to understand individual motivations for participating and previous experiences of technology use.

> *"In a way it is probably good that I have done a lot of the training because I've had this kind of sort of phone relationship with a lot of them and had the conversations [. . .] [. . .] I'm slightly different with each one because you know they're all different and how they are with me [. . .] I kind of bounce back that either same level of energy or you know, if there's somebody who is really quite into laughing and joking around I will match that" (Instructor).*

> *"It was personalized to me, very much so" (P020, Age 79)*Importantly, for online digital skills delivery, the instructor was able to understand an individual's barriers to participating in the programme. For example, not having access to broadband, or a second device for online programme delivery. This had implications as to what device the individual received and how the training was completed.

> *"She had her sort of standard format that she wanted to cover, but then she adjusted that [. . .] if we got to something, she'd say, do you understand this? [. . .] Are you familiar with it? And sometimes I was familiar with certain aspects. So, we were able not to spend time on those too much" (P032, Age 71).*

Whilst this resulted in a positive experience for participants, it was labor intensive, and potentially unsustainable for future programmes.

> *" [. . .] I'd allowed sort of 15 min per phone call and you know there were some I was on for an hour and a half" (Instructor).*

As this programme was delivered on a one-to-one basis, the instructor was able to tailor sessions to individual needs after providing some generic training information. Importantly, this allowed personalization in both learning style and content. A mix of both basic digital skills training and more personalized training materials was seen as beneficial. Not only did this allow individuals to develop the skills they found most useful, but it also added value to the training and participants thought this would be more useful than group training.

> *"There was one individual [. . .] she's got an amazing garden and she loves taking pictures of the flowers, but she didn't know how to send them to people. So instead of going round two of the simple apps. I went round one of them and then we went straight into camera, and we did over an hour just inside the camera and she was taking various pictures in her house" (Instructor).*

> *"I think if you were trying to do it in a group, it would be difficult, because okay, some things would be common, but for example, my problem with my router password [. . .] it wouldn't really*

TABLE 2 Themes and sub-themes generated from the data.

Creating a unique learning environment	Personalization
	Building rapport
	The digital vs. in-person environment
Encouraging further learning	The learning journey
	Wider barriers to online participation

> *have been of interest to other people, and it took up so much time" (P016, Age 79).*

As well as recognizing the importance of specific learning content, this one-to-one programme enabled the instructor to recognize the importance of individual differences in learning style and designed the training around this, arguably improving their learning experience and empowering the learners in this process.

> *"It's been nice to see how different people learn" (Instructor).*

In delivering more tailored content, in a way that most benefited the learner, this tailored approach also allowed accessibility options to be explored for each learner, once more, empowering individuals to utilize their digital device in the best way for them. Some participants found it difficult to interact with the iPad due to sight impairment, hearing impairment, or dexterity issues. Accessibility options were described as one of the greatest benefits of training.

> *"And then this is how you can put a screen saver shot on and this is [. . .] how you can make the words, the text larger if you want to" (P032, Age 71).*

Participants described how the training 'debunked' the iPad for them. Many participants described how different the iPad was to the technology they had previously used, e.g., a laptop or desktop computer. This was primarily through lack of on-screen text, which is replaced by apps, jargon, and a touchscreen.

> *"it's about finding a way to make it not sound complicated. Not make them feel stupid, like oh I should have known that but also make it that they actually want to keep learning, because tech stuff [. . .] it is the most boring thing in the world and if you don't know how to do something" (P001, Age 76).*

This debunking was facilitated through personalized, one-to-one learning, in which the instructor built up a relationship with each participant and began to understand their own needs and difficulties.

"She focused on all the little symbols. [. . .] the little symbols on the iPad that I didn't understand and then she taught me about the eBay" (P015, Age 88).

Building rapport

Several participants exhibited low confidence with their own digital skills and often made self-deprecating comments about themselves and their abilities.

> *"I would like to get my training [. . .] because I really don't want to be labeled a slow person when I'm not really a slow person" (P019, Age 84).*

P018 made several negative comments about herself being "*stupid*" and demonstrated extremely low confidence.

> *"I'm not that clever" (P018, Age 80).*

> *"I must seem very stupid to you. I'm sorry" (P018, Age 80).*

It was important for there to be a sense of familiarity between the instructor and learner to recognize these self-held beliefs, and often aging stereotypes, as potential setbacks to learning. In the WW.it programme, there was one instructor throughout the duration of the programme, and this familiarity helped to develop the relationship between instructor and learner, facilitating learning.

> *"I liked her on the phone. I think it helps to like the person" (P001, Age 76).*

This familiarity was especially important to those who were anxious about using technology and starting the training programme.

> *"She understood and she knew everything, and she really was a benefit and of course the mistakes that I was making there, in my training, but that helped because the same thing was happening when I was trying to work it on my own and for her to explain what all these other things were" (P015, Age 88).*

Participants felt very comfortable with the instructor. This undoubtedly facilitated their learning and was important for their enjoyment.

> *"And she wasn't rattling off the information and she's an incredibly patient person and no, I look forward to it [. . .]I don't* ***realise*** *I've learnt a lot and you know, until she'll say something, and I think, oh yes, I know what you mean" (P001, Age 76).*

In this unfamiliar learning environment, and with unfamiliar technology, participants often felt unable to articulate their digital needs or struggles. In an online environment it was more difficult for them to show the instructor the issue, and consequently, they could feel 'flustered' and uncomfortable. Participants described how the instructor's patience helped them feel more comfortable when learning in this environment, and with unfamiliar equipment.

"She was so patient and understanding and the bits that I was not understanding, and you know, fumbling about and not being able to change pages and everything. She understood what my problem was, and she was able to help me" (P015, Age 88).

The digital vs. in-person environment

It was clear participants presented individual differences and needs in terms of the learning environment. Whilst participants appreciated the changes to the running of the WW.it programme from in-person, group sessions, to online, one-to-one sessions, through the COVID-19 pandemic; there was an awareness of limitations and, for some, a preference for face-to-face training moving forward.

> *"Well I think the training really was difficult. I think I would really like somebody who comes to my house" (P020, Age 79).*

For some, online learning was daunting as they were unfamiliar with the online environment.

> *"In the way that we've had to deliver the training. I mean I'm doing 99% of the training online one to one. [. . .]I mean a lot of these ladies had never, never been online before in their lives, never mind suddenly doing a training session over a video call, online" (Instructor).*

Once more, the instructor's skills were fundamental to this method of training, which was "*as good as it could be under the circumstances*" (P016, Age 79).

> *"And how she tackled it at a distance [. . .]I couldn't necessarily explain to her all the time what was showing on my screen. So, I was having to hold up, you know, my computer so she could see what I could see, and she would do that [. . .] for an hour at a time, an hour and a quarter [. . .]. It must have been absolutely draining for her mentally, but I mean, she was so patient and so good sorting things out for me" (P016, Age 79).*

Participants made suggestions of how the online, remote training sessions could be further improved. For example, an aide memoir, or a programme handbook, to accompany sessions and facilitate remembering content during and in-between sessions.

> *"Just something simple, points, you know, if you want an attachment for example, you know, this is what you do" (P010, Age 76).*

This was suggested as a way of remembering the content of the session and as something to look at in-between sessions.

> *"If we'd also had access, perhaps even on the website in the members area, like an aid memoire where you can go on there because after, I think it as an hour, I had with [anonymized] [. . .] it was quite intense, and we covered a huge amount, but then as you are starting to do things as the weeks go on, you think, now what did she say? [. . .] which keys do I press?" (P032, Age 71).*

Some regretted not having taking notes during their training session to refer to when practising at home alone.

> *"The only thing I regret about it, I didn't think to take a pen and a paper with me to write down, there and then so I could sit and look at it and say now remember this bit, what happened there and why did you do it and now do it" (P015, Age 88).*

Participants also recommended shorter, more frequent sessions, as opposed to one 2 h session, feeling this would aid learning and allow them to practice skills in-between sessions.

> *"Well, I would suggest that you did it in sound bites. Instead of a whole 2 h all at once [. . .] Teach somebody one thing maybe over 10 min and then tell them to practice" (P021, Age 78).*

The repetition and opportunity to practice may have supported skills development and retention.

> *"It's something I haven't retained because I haven't used it and you need repetition to do that" (P026, Age 66).*

This would also have given participants the chance to ask questions when the next session resumed.

> *"It was fairly intense, and you had to keep up with it [. . .] it's not always easy to do that in a very limited amount of time with something new. You often need to pause, think about it. Make sure you've understood it and then ask any questions if you've got any, but obviously that wasn't possible" (P032, Age 71).*

Group, face-to-face sessions were considered potential opportunities of sharing with peers, which was not possible when online and in a one-to-one setting.

> *"Doing it face to face or even if it was possible to join a few of us together in one area. And you get [. . .] a connection there, you know, before you do anything else and then you learn together. And then you keep sharing together and you know, in touch together and then you can ask questions a lot more and yes, you know, you are time limited doing that hour. I mean if it had been more than one session and if it had been face to face, it would have, yes, obviously it would have been probably even more useful" (P032, Age 71).*

However, some participants did weigh up both pros and cons of group learning, acknowledging the drawbacks to doing this as a group, such as through reduced session personalization.

> *"I do appreciate individually you would get more attention from the trainer"* (P026, Age 66).

> *". . .the one to one for me was far more beneficial" (P016, Age 79).*

Secondly, the geographical dispersion of members of the WWA was recognized as a barrier and, as a national programme, would make it difficult to get individuals together in one place.

> *"COVID has really changed the entire way that we've had to look at the project [. . .] ideally the training was going to be used as a social thing as well and I was going to try and get people from as close as possible together. Which was actually proving to be quite difficult anyway because actually the members that have taken part in the project are very, very far flung and spread anyway" (Instructor).*

Summary

The first theme highlights the importance of personalization in delivering the WW.it programme, in terms of understanding motivations for participation, as well as previous experience and use of technology. Through this, there was a deeper understanding of the barriers to digital use and this understanding assisted in developing the programme to suit the participant's individual needs. Not only did this help empower the learner and improve accessibility, but this also influenced the perception of the programme. The rapport between the participants and instructor was vital in facilitating learning and how receptive the participant was to learning digital skills, particularly to those who were initially anxious due to limited previous experience.

Participants suggested that future training programmes should occur in a group, face-to-face setting to enable peer-to-peer discussions, however, this could impact the personalization of the programme and could be difficult to achieve due to geographical dispersion. Future online, remote sessions could be further improved by utilizing aide memoirs to facilitate practicing digital skills outside and following completion of the digital skill programme. Further suggestions included shorter, more frequent sessions.

Encouraging further learning

The learning journey

For many participants, the WW.it training was the first digital skills programme they had attended to support their use of digital technology, and it was the first programme all participants had attended which was focused on the iPad. For some, there were barriers that remained which negatively influenced their ongoing use of the iPad.

> *"I have to be honest with you, I find it very difficult" (P006, Age 90).*

The WW.it programme was flexible in that the participants who required further training were able to request this, however, this training was not intended to be continued long-term. Multiple participants discussed the need to contact the instructor with additional queries.

> *"[The instructor] has said to me she will be in place, so to speak, until the end of November. So I will send her an email with the question and get an answer to that" (P016, Age 79).*

> *"It is a learning curve, it's quite a steep learning curve, but I haven't [. . .] the thing that I've got to get sorted with her and I will ring her about it is the [. . .] is this other thing, is this email [problem]" (P020, Age 79).*

For most, the sustained learning needs were through their fresh understanding of the iPad and its potential. Participants picked up basic skills, and some personalized to their needs in the WW.it programme, but they discussed areas in which they required continued learning – either formally, informally through friends and family, or through self-led practice and discovery.

> *"I did go to the library every day, you get 2 h free at the library. So I could always stay in touch there" (P021, Age 78).*

> *"I have been able to take it down to the local library and get on to the internet connection thing down there and another one in the coffee shop in town" (P023, Age 71).*

> *"So, there are just things that I keep discovering that are out there which perhaps I didn't really use or know about really" (P032, Age 71).*

The programme was a launchpad for participants' learning and it is evident that further learning was needed as time moved on. This must be taken into consideration when considering similar programmes in the future.

Whilst participants were engaged in the WW.it programme for a specific period of time, they discussed their intentions of sustained learning through informal networks (i.e., family and friends) or formal digital skills training programmes. However, methods of sustained learning were not always positive or well-received. It was clear that family support was important for technology use, and in some cases, family members gave them devices as a gift.

> *"Just a few months ago my son gave me, is it called an iPad? And he showed me how I could read the Daily Mail" (P015, Age 88).*

> *"I've got a few nieces. My other niece has. . . is quite savvy and she said, bring your tablet round and we will have, every Tuesday, because I go to her house every Tuesday for dinner" (P021, Age 78).*

Relying on family members for ongoing support was not always straightforward, however, and some participants were concerned about seeking help and being seen as a burden. Some described the guilt they felt from asking their family for help, partly through time constraints.

> *"But you see, if you had the grandchildren and children, they haven't necessarily got the time to teach you, because people are so busy working" (P001, Age 76).*

> *"I don't progress very much because I don't want to keep going pestering my son saying, how do you find this, how do you find that?" (P015, Age 88).*

Some also described feeling 'stupid' or acknowledged their family's frustration when trying to support them with technology.

> *"[My family have] given up with me. They think I'm such an idiot that trying to explain technology to me is a waste of time. So they've given up" (P026, Age 66).*

However, for some, the support provided by family members was perceived to be inadequate. It was suggested that some children did not have the patience to demonstrate how to use certain functions or make assumptions about their skills.

> *"But then they fit us up with the technology, but they assume that we will know how to use it" (P010, Age 76).*

> *"She just tells me, oh mum, I can do it quicker and then, so she does it for me" (P018, Age 80).*

Not all participants had family to support their continued learning, and this is important to consider within future digital learning programmes, especially when considering peer support that may be offered from group sessions.

> *"See I don't have children. I don't have nieces and nephews handy. There's no sort of 12 years-old I can go to" (P016, Age 79).*

One participant, reflected on family dynamics for those who were aging without children, and commented that peers suggest asking their children or grandchildren. It was felt that there was an assumption that they had a family, and that family would be able to help.

> *"So yes, all of us don't have family. So, we don't actually. . . They say go and ask your grandchild. We don't have them to ask" (P001, Age 76).*

Some participants sought out peer support from friends and neighbors.

> *"I have to try and get other people to help me [. . .] I have a new next-door neighbour and she'll sort of come in" (P020, Age 79).*

> *"He is the son of someone who used to live in the same street. He is very, very good and he is retired so you know he is free in the daytime. But of course, at the moment we can't do anything because we are not allowed[. . .]" (P016, Age 79).*

Of course, this support was not always available, as discussed by P016, above, in the context of COVID-19 social restrictions.

The WW.it programme supported ongoing personal development. Whilst this formal sustained practice was sought through the WW.it programme, and was intended to supplement this, barriers related to both COVID-19 and geography meant that this was not possible.

> *"I mean I had already started making links with charities and what not [. . .] some charities were like, oh we'd love to help you, but [. . .] we don't have anybody in our area [. . .] There is a charity that does have digital champions and they cover the UK and I thought, great, I am glad I found you, but again they're still trying to find volunteers to cover lots of areas. So still they have quite a few areas where our War Widows are, that they don't have anybody" (Instructor).*

Importantly, participants were not always on the receiving end of this training and demonstrated a genuine desire to empower their peers. P007 reflected on how many of her peers have not been given adequate training and discussed her plans to share her knowledge and skills after the WW.it training. This was a positive, and unanticipated ripple effect from the project.

> *"I have people already who are queuing up now who want me to train them on iPads they have had for ages in a drawer, because their family members don't get round to showing them how to use the device to its full potential" (P007, Age 88).*

Wider barriers to online participation

Despite the want, and need, for further digital skills training, there were barriers to accessing or engaging with digital technology. These were both community-specific factors, including COVID-19 restrictions and lack of access to digital technology outside of the home, and personal factors including self-perceived aging stereotypes and health status which hindered individuals' own perceived autonomy of using digital devices and increased feelings of vulnerability.

COVID-19 had an extraordinary impact on digital technology use within their own daily living. Some were left feeling "*vulnerable*" *(P001, Age 76)* through digital exclusion.

> *"You had to be online, and I realized that I wasn't" (P001, Age 76).*

Restrictions associated with the pandemic also halted the support individuals received from community organizations.

> *"until we had the pandemic, anything I was stuck on I used to pop down to our local library which has computers and get their advice, but of course that is missing now" (P010, Age 76).*

The restrictions caused by the pandemic meant that individuals had no way to access or engage with digital technology outside of their own home until they were enrolled onto the WW.it programme. Not only did COVID-19 negatively influence digital technology use in the community, but also restricted support received from friends and family who were unable to visit.

Participants considered their own aging as a barrier which hindered digital access and use. Some used self-deprecating terms such as being a "*dinosaur*" *(P026, Age 66)* when discussing their lack of digital awareness or skills. These increased perceptions of

intergenerational 'othering' where younger generations were more digitally aware, engaged and capable than themselves.

> *"And they are getting left behind and if you get left behind, youngsters think you're a thicko, you know, you've got not brains" (P021, Age 78).*

Participants discussed how people of their generation are not particularly engaged with technology, unless through the encouragement from younger family members.

> *"I don't think people of our generation are really but I mean we've got them. Really thanks to our children's efforts sort of saying, you've got to be able to do this and you've got to be able to do that" (P010, Age 76).*

Consideration was also given to the biological impact of aging and how this can impact the learning process.

> *"And as you get old, because I am 87. It does take you longer to absorb things" (P022, Age 88).*

Participants' health status, including dexterity problems and eyesight issues, also influenced their use of technology.

> *"But you see my hands are getting slower and with arthritis you hit the wrong buttons" (P022, Age 88).*

> *"I found Windows difficult because of the [. . .] the glare from the screen and my contact lens woman gave me a shield, but it made it so dark I couldn't see it. I couldn't see the screen" (P001, Age 76).*

Summary

Encouraging further learning explored the value of long-term training and learning following the programme completion. This continuation of the learning journey was achieved formally through other training programmes, informally via friends and family, or was self-led. Whilst informal peer networks were valuable in receiving support with queries and encouraging further learning, there were barriers to seeking this support, such as feeling like a burden. Further barriers to continued learning included geographical restraints and the continuation of the COVID-19 pandemic which was occurring at time of data collection.

The subtheme *wider barriers to online participation* noted the influence of community-specific factors and self-perceived aging stereotypes and health status. The COVID-19 pandemic and resultant national lockdowns resulted in feelings of vulnerability and prevented access to previously available community support networks. Self-perceived stereotypes regarding age and abilities, along with health concerns, also impeded access to further learning.

Discussion

This study aimed to explore the perceived facilitators and barriers of the online digital skills programme, WW.it, and to reflect remote, online, one-to-one training as a possible alternative to traditional face-to-face models.

Unintentionally, this study has become one of the first studies to evaluate online digital skills delivery for older adults (females) in the UK during the COVID-19 pandemic and national lockdowns. This model for digital skills training was unique, utilizing remote, one-to-one digital skills delivery to individuals who had very little to no previous experience of using technology. Through this unique implementation and delivery, there were clear identified elements of training and lessons learned for future implementation. Furthermore, it is recognized that this training programme sits in the wider context and relies on other elements to sustain reach and impact.

Personalized content through familiarization between the instructor and learner, and one-to-one learning, was a major benefit of the WW.it programme and enabled participant empowerment. Learners described their anxieties in beginning training however, the relationship they had with the instructor eased concerns. Building a positive relationship with older adults enhances learning (Wlodkowski, 1999). Evidence demonstrates the ineffectiveness of non-personalized ICT courses in supporting older adults to get online (Age UK, 2018). The personalized approach taken within the WW.it programme enabled the instructor to recognize individualized content and individual learning needs. These are both key components of the Critical Geragogy learning theory (Findsen and Formosa, 2012), and are reflected in the digital skills reflective tool for older adults (Gates and Wilson-Menzfeld, 2022). Acknowledging these issues can reduce perceived barriers or accessibility needs (Seo et al., 2019).

It is beneficial when learning is relatable and mimics real world scenarios (Peterson, 1983). Personalized learning can support this learning style, enhancing the value an individual sees from digital technology (Brown and Strommen, 2018; Seo et al., 2019; LoBuono et al., 2020). The recognition of the tangible outcomes from using the internet is one component of digital exclusion (Van Deursen and Helsper, 2015). Many participants did not recognize the potential benefits of the iPad or the internet as they had little to no prior experience of use, as is recognized in wider literature (Tsai et al., 2015), however, through personalization of this digital skills programme, they were supported to use this device for their own interests and consequently learned how this technology could benefit themselves, and their own daily living. Whilst instructors, and their relationship with each learner, differ between programmes and cannot necessarily be replicated, the importance of developing a relationship with learners, and the consistency of an instructor on a digital skills programme, is recommended from this study. However, it is important to consider the practicalities and sustainability of this method on a larger scale. This relationship building and understanding of an individual's needs took time which may not be possible depending upon funding, programme length, and group-based support.

Despite some of the advantages to utilizing online, remote learning, participants sometimes found it difficult to learn digital skills remotely and consequently still preferred face-to-face, group learning. The social advantages of group learning are notable. Group settings encourage peer learning and support, enhance social inclusion (Wlodkowski, 1999), and increase confidence (Zaidman and Tinker, 2016). Vygotsky (1978) suggested that whilst individual learning could increase knowledge and skills, collaboration with more informed peers could further enhance this and expand the zone of proximal development, the distance between current developmental stage and maximum potential development. This

could indicate that knowledge of digital skills could be further enhanced through interaction and learning with peers.

When suggesting improvements for the WW.it programme and the online learning environment, participants made various suggestions for additional learning materials, such as an aide-memoire, along with shorter, more frequent sessions. Flexibility, pace, repetition, and reflection are some of the good-practice principles suggested to engage older adults in technology use (Age UK, 2018; Centre for Ageing Better, 2018) and, once more, reflect key components of learning theory (Formosa, 2002, 2012). The use of additional materials, or adapted session layouts, may have supported continued learning after the training had ended. Remote, online digital skills learning can be advantageous for various reasons, including inclusivity, accessibility, and cost, however, it is not preferred by all learners. It is critical to consider the needs of learners and examine the benefits or drawbacks of this approach before implementation.

Learning does not only occur in one discreet setting. It was evident that individuals were empowered to continue learning informally outside of sessions, through friends and family members. For many participants, the WW.it programme was just the beginning, and many wanted to continue partaking in other formal digital skills training sessions to further improve their skills. There were however, some barriers to digital skills learning, both as part of the WW.it programme and further learning.

All participants in this study were female and over 65 years old, and perceptions of their own aging was a barrier to their digital learning. Aging stereotypes are considered as being a barrier in Critical Geragogy (Findsen and Formosa, 2012) and evidence demonstrates the power of self-considered aging stereotypes and low self-efficacy in learning (Neves et al., 2013; Wilson et al., 2021). These self-perpetuating views can be exacerbated through prior negative experiences of learning new digital skills (Centre for Ageing Better, 2018). Critical Geragogy and the reflective tool for the delivery of digital skills for older adults (Formosa, 2012; Gates and Wilson-Menzfeld, 2022) promotes the importance of challenging negative perceptions of aging, across both learners and instructors. By challenging these assumptions and encouraging self-efficacy, learners are more likely to have the willingness to use digital services.

Additionally, individuals perceived their own health as a barrier to digital skills learning through lack of accessibility, as recognized in the evidence base (Neves et al., 2013; Wilson et al., 2021). In this study, health needs predominantly included eyesight and dexterity issues. Critical Geragogy recognizes the different physical, as well as emotional and social needs of older adults and something that needs to be considered in the learning environment (Formosa, 2018; Hunsaker and Hargittai, 2018).

Strengths and limitations

Through examining remote, online digital skills training for older adults, a strength of this study is its original contribution to knowledge in the field of digital inclusion. However, there are also limitations to this research. Due to the nature of WWA membership, this sample consisted of all white females, over 65 years old. Whilst this represented the organization in which the WW.it programme was implemented, it limits how the findings can be translated to the wider population. Furthermore, the voluntary nature of study sampling means that the study included individuals who were interested in technology. Whilst, arguably, anyone participating in digital skills training, as part of research or not, is self-selecting, this voluntary sample is not representative of all perspectives on digital learning and technology use.

Recommendations for practice

The WW.it programme did not utilize the reflective tool for delivering digital skills to older female participants from the offset, and it is recommended for future programmes to do so to optimize the learning environment.

One recommendation from this study is to consider the importance of learning theories, in this context Critical Gerontology, when designing and delivering digital skills programmes. For example, through recognizing the importance of self-held aging stereotypes on learning, and placing emphasis on individual learning styles, through use of the reflective tool for delivering digital skills to older adults. Multiple practical recommendations for digital skills training also arose from this study and are recommended for consideration in future delivery programmes aimed at older adults, for example, shorter sessions spread across several weeks, face-to-face, group classes (where possible), additional materials to accompany training, a focus on accessibility settings, and personalized learning and content. The consistency of instructor and relationship building should be a priority when planning digital skills training programmes.

Finally, signposting information should be provided by organizations for learners to seek further training once programmes are completed, with the recognition of wider barriers of digital use, such as access inside and outside of the home. This could be through local digital champions, national digital organizations, textbooks, or online-only resources.

Recommendations for future research

Research that considers online digital skills training programmes is still in its early stages and further work is needed to expand the evidence in this area. Further research is also needed to examine the impact and effectiveness of digital learning in a group setting as this appears to be scarce. This study acknowledges the homogeneity of its sample and further research must consider the inclusion of wider cohorts to be more reflective of the wider, older population. Future research in this area should utilize the reflective tool for delivering digital skills to older adults (Gates and Wilson-Menzfeld, 2022) when evaluating programmes to improve digital skills, as this is the first study to do this.

Conclusion

The WW.it programme aimed to empower older women through digital inclusion, and to support the development of new skills to connect with others online, by providing iPads and/or iPad training.

Due to the COVID-19 pandemic, this programme took an unexpected and unique route to delivering these digital skills through online platforms. This paper has reflected on the remote, online, one-to-one training as an alternative to face-to-face models, and has explored perceived facilitators and barriers of the programme. The participants in this study were new to the digital sphere, and due to the pandemic, had to learn digital skills using an unfamiliar and online format. While this online environment isn't suitable for all, there were benefits to this mode of delivery, such as a personalized approach that was valued by participants. This study also emphasizes the importance of a developing the instructor-learner relationship.

Participants developed basic skills, personalized to individual needs, and many sought additional learning through formal training, informal assistance by family or friends, or self-led practice. However, some of these avenues were limited due to COVID-19 restrictions, fears of being a burden, or lack of access to familial support. Self-perceived aging stereotypes and health issues could impede perceived autonomy of using digital devices.

This programme exhibited the ethos and principles of Geragogy and Critical Geragogy, and while undoubtedly encountered barriers, it promoted the empowerment of participants to learn relevant digital skills through a programme tailored to suit their needs.

Data availability statement

The datasets presented in this article are not readily available because participants have not consented for full interview transcripts to be made publicly available. Requests to access the datasets should be directed to GW-M, gemma.wilson-menzfeld@northumbria.ac.uk.

Ethics statement

The studies involving human participants were reviewed and approved by Northumbria University Health and Life Sciences Ethics Committee (ref: 120.3305). The patients/participants provided their written informed consent to participate in this study.

Author contributions

GW-M study PI and oversaw the running of the whole project. GW-M, HR, and JG completed participant recruitment. GW-M, JG, MM, and AJ completed qualitative and quantitative data collection and/or analysis for both stages of the project. GW-M led on writing the submitted manuscript with AJ, JG, and MM. HR contributed to the writing sections. All authors contributed to the article and approved the submitted version.

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Conflict of interest

MM was the Chairman of the War Widows' Association of Great Britain at the time this research study was completed. HR was an associate Member of the War Widows' Association of Great Britain and was contracted by this association throughout project duration.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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Ageing, the digital and everyday life during and since the Covid-19 pandemic

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Introduction: During and since the Covid-19 pandemic there has been an intensified integration of digital technologies into the everyday lives of older people. We do, however, know little about the ways in which older people incorporate digital technologies and communications into their daily lives and their own meanings, embodiment and experiences of the digital during and since the Covid-19 pandemic.

Method: The aim of our research was to explore the use of digital devices during and since the Covid-19 pandemic and to identify facilitators and barriers to incorporating digital devices into everyday life. The research involved a series of online focus groups with people aged between 63 and 86 years living in the United Kingdom and were conducted in 2022. Each focus group lasted around 90 min and data was audio-recorded and transcribed. The data was analysed thematically.

Results: From the analysis, three interconnecting whilst analytically distinct themes around the meaning and experiences of using digital devices in everyday life during and since the pandemic, are thematically presented as: (1) Incorporating the digital into everyday life; (2) Social and digital connectivity; and (3) Challenges and limitations of the digital in everyday life.

Discussion: The research has provided insights into the way digital devices were used by older people during and since the Covid-19 pandemic. In particular, we highlight the increasing importance of digital connectivity and the ways in which older people actively engage (and resist) technologies of communication in their daily lives; and the significance of embodied co-presence and the immediacy of shared space and/or time is highlighted.

KEYWORDS

ageing, digital, time, space, rhythms, everyday life, COVID-19 pandemic, social connectivity

1. Introduction

1.1. Ageing and the Covid-19 pandemic

The Covid-19 pandemic significantly impacted the everyday lives of older people. Firstly, the virus itself caused a disproportionately higher number of excess deaths in older adults (Rossen et al., 2020) which subsequently led to heightened fears and anxieties associated with

this demographic (Agrawal et al., 2021). This elevated level of concern for the wellbeing of older people also led to an increased emphasis on the possible vulnerabilities of older people in terms of rules and regulations around social engagement and social isolation.

One of the consequences of this can be seen as a heightened sense of being "old" and an enhanced sense of vulnerability among some older people, more so than before the pandemic (Shrira et al., 2020). This was demonstrated by a study of letters written by older adults in Finland during the pandemic (Leinonen, 2022). Leinonen presents three key themes that were described as: (1) *not being*: that denoted social isolation and changes of identity, particularly the idea that one is old and frail and with needs; (2) *not having:* that describes the invisible virus, not seeing or hearing people, items missing from shops; and (3) *not doing:* the withdrawal and disengagement from other aspects of life but also new, different freedoms that has been described as the "unlived life" and appears to represent a shared experience of older people during the pandemic.

These issues amongst older people were moreover exacerbated by rising ageism that appeared to emerge during the pandemic (Fraser et al., 2020). This appeared in a number of forms, with the most prevalent being the narrative that all older adults were significantly viewed as at high risk and perceived as more vulnerable than the majority of the rest of the population. Another area that became more salient during the pandemic were predominant ageist narratives around older people and the use of digital technologies in everyday life (Ehni and Wahl, 2020; Mariano et al., 2020; Swift and Chasteen, 2021).

1.2. Ageing and the digital

Digital technology is a realm in which older adults have consistently experienced ageism in a number of ways. Firstly, the perception of older people as being incompetent and unwilling when it comes to digital technology serves as not only a prejudice, but also a barrier towards greater use of this technology in this population (Gates and Wilson-Menzfeld, 2022). The increasing integration of the digital into everyday life (something exacerbated by the Covid-19 pandemic) also may leave older people who are not fully assimilated into digital use, at a clear disadvantage in a number of ways (McDonough, 2016), further exacerbating this digital ageism. In addition to these issues, the vast majority of digital technologies and platforms are simply often not designed with older adults in mind, adding another layer of discrimination and ageism into the use of digital technology (Rosales and Fernández-Ardèvol, 2020).

Despite this, digital technology may provide a wealth of benefits to older adults including memory aids (Atkinson and Barker, 2020), mental health and cognition (Yoo et al., 2022), facilitating communication and social connections (Marston et al., 2019) and a range of wider health and wellbeing benefits (Augner, 2022). There is also a wealth of evidence showing that many older people are embracing digital technology and in particular usage of mobile phones, emails and the internet are common in older people in developed countries (Marston et al., 2019). Older adults are a heterogenous group with technology usage varying widely amongst them and whilst rates of digital participation decline with age, there is still a high degree of variability at all ages up to the oldest old (Taipale et al., 2021). In addition to this, older people are often taking a proactive role in not just using digital technology but also in helping to develop and create digital technologies, particularly in fields where they have been identified as being particularly useful for this demographic (Kania-Lundholm and Manchester, 2022). There are signs that the producers of digital technology and platforms are starting to understand the importance of older adults as a heterogenous and growing section of the population be included in the design of technologies in order to maximize their function (Mannheim et al., 2019; Peine et al., 2021). This could prove to be very important moving forward, as digital technology provides a huge range of potential benefits for older adults including physical functioning, information access, facilitating social connections and health monitoring (Sheng et al., 2022).

1.3. Older adults, the digital and Covid-19

The gap between those who have access to digital technology and those who do not has been coined the "digital divide" (Van Dijk, 2006), and extends to a number of demographics including those without access in developing countries, rural communities, those with certain disabilities and older adults (Van Dijk, 2020). Access to digital technology provides only the first level to this divide, with knowledge and skills for usage and the ability to use digital devices to achieve specific ends representing second and third levels to the divide, which has become more pronounced as a result of the Covid-19 pandemic (Aissaoui, 2021). It has been suggested that this divide exists as a result of these practical difficulties rather than an unwillingness amongst certain groups (including older adults and rural dwelling groups) to adopt such technology (Freeman et al., 2022). Digital technology usage has increased in, and heavily influenced a number of key areas of society including healthcare, education, workplaces and home life and extend to a range of both hardware and software versions (Vargo et al., 2021). This innovation and subsequent reliance on digital technology in a number of areas of life has only exacerbated many of the inequalities that already existed between groups with greater access to and familarisation with the digital and those without (Lai and Widmar, 2021). Whilst tired stereotypes of older people as uninterested or unskilled users of digital technologies have waned, concerns over a digital divide remain and necessitates more about the meanings and experiences of ageing and the digital in everyday life (Peine et al., 2021).

1.4. Ageing, the digital and everyday live during Covid-19 pandemic

Contemporary and global societies are characterized by changes in meanings and experiences of space and time. There has been a move from predominately face-to-face relationships in which time and space are inextricably linked, to an increasing separation of time and space resulting in more disembedded and distanced social relationships (Giddens, 1991). Massey (1994) criticizes the dualist tendency of conceptualizing space and time as bounded and separate, and instead states that space and time are intimately interconnected, and are constructed out of social relations, within a context in which social relations are dynamic and changing. Interconnections of time and space are seen to coexist in everyday life and shape the meanings,

flows and experiences of daily routines and practices (Lager et al., 2016; Lyon, 2019). The concept of rhythms in everyday life draws on Lefebvre's Rhythmanalysis (2004) and argues that time and space are inextricably interwoven: 'everywhere where there is interaction between a place, a time and an expenditure of energy, there is rhythm' (Lefebvre, 2004, p. 15). The ordering of everyday life and the flows and rhythms are moreover derived from daily practices (Lager et al., 2016). The emergence of cultural gerontology has further highlighted the significance of meaning and lived experiences of people in later life in the context of time, space and everyday life (Twigg and Martin, 2015a,b).

A focus on everyday life brings attention to the taken-for-granted, the ordinary, the mundane, the day-to-day, the habitual, and the rhythms, and routines of daily life (Katz, 2018). The Covid-19 pandemic disrupted the daily lives of older people and it is in this context that social connections, routines and rhythms of everyday life significantly changed alongside the ways that older people increasingly used digital devices and technologies. During the Covid-19 pandemic in the United Kingdom there were significant impacts on daily lives for at least 2 years from March 2020 with a series of public health restrictions including lockdowns and social distancing, when mobilities and movements were very limited and people were at times mainly required to stay at home. The rhythms and routines of everyday life were disrupted and the usual connections with friends and family and wider contexts of work, care, and leisure in-person were limited.

Digital devices, information technologies and mediated systems of communication have increasingly shaped the social worlds of people as they grow older (Peine et al., 2021). Digital technologies permeate everyday life and have become interwoven with our identities, narratives, social relationships and the rhythms and routines in everyday life. We do, however, know little about the ways in which people in mid-to-later life incorporated digital technologies and communications into their daily lives and their own meanings, embodiment and experiences of the digital during and since the Covid-19 pandemic. The aim of this paper is to highlight some of the ways that older people performed, mediated and experienced the use of digital technologies during and since the Covid-19 pandemic; to explore the meanings and experiences of digital technologies in everyday life; and to identify facilitators and barriers to incorporating digital devices into everyday life.

2. Data collection methods

The research involved three online focus groups with people aged between 63 and 86 years living in the United Kingdom and were conducted in 2022. The study was approved by the Brunel University Research Ethics Committee (Reference: 30547-LR-Dec/2021-36960-1). Informed online consent was gained from all participants prior to data collection.

2.1. Participants

This study involved members of the Brunel Older People's Reference Group (BORG) which is a database of approximately 262 local adults aged over 50 years old who are interested in participating in research studies and have agreed to be contacted. BORG members live in West London and the surrounding area. Those on the BORG database were sent a general email inviting them to express an interest in the research. The study was also advertised at BORG community research online events and advertised during monthly online BORG meetings. Those who expressed interest were sent study information and consent forms and were also asked to share the study information with other potentially eligible participants. In addition to being aged 60 and over, participants were eligible for the study if they currently use at least one digital device or technology, such as a tablet, laptop, smart phone, or wearable wristbands (e.g., Fitbits, digital watches, and others) in their everyday life.

A total of 12 participants aged between 63 and 86 participated in the study (mean age = 76 years). Most participants were female ($n = 10$), and all identified as White ethnicity and were homeowners (Table 1; participant names replaced by pseudonyms).

2.2. Data collection

Due to the ongoing pandemic and possible increased vulnerability to adverse health outcomes of Covid-19 amongst older adults, and the enhanced Covid-19 restrictions of the ethics committee that limited in-person research, the data was collected using a series of online focus groups conducted using Zoom software (version 5.9.3). The focus groups were led by two researchers—one as a facilitator and one as a moderator and took place between 25th February 2022 and 28th March 2022.

Focus groups are moderator-facilitated group discussions organized to explore a specific set of issues and are distinguished from group interviews in that there is a component of 'group interaction' which contributes to the research data (Kitzinger, 1994). This methodology was chosen because focus groups are an efficient way of gathering multiple perspectives and opinions on the use of digital devices during Covid-19 pandemic. It is also an effective means of eliciting meanings, insights and norms and values among social groups (Barbour, 2014).

There were five participants in focus group 1, four participants in focus group 2, and three participants in focus group 3 ($N = 12$). The focus groups were semi-structured meaning that each focus group followed an interview schedule but with the opportunity for free discussion if the discussions (for example, in relation to embodiment, surveillance, and data tracking) were relevant to the research question.

The focus groups began with a preface to reintroduce the study, the researchers, to explain the purpose of the focus group, and reiterating rules of confidentiality and voluntary participation. After introductions, discussion was elicited by asking each participant "are digital technologies important in your everyday life since Covid-19, and why?" and "has your use of digital technologies changed in Covid-19? If so, in what ways?"

Discussion was also elicited by asking participants what digital technologies they had used since Covid-19 pandemic but not before the pandemic, what do they enjoy about digital technologies, and what worries or concerns do they have about digital technologies. We also explored the use of digital devices in specific contexts, namely the use of digital devices in healthcare, the use of digital devices as memory aids (e.g., daily reminders, organizers), and the use of digital devices to enhance and maintain social relationships.

Due to more exposure and an increased use of online means of communication during Covid-19, many of the participants were

TABLE 1 Participant demographic information.

Pseudonym	Focus group	Age	Gender identity	Marital status	Ethnicity	Employment status	Previous/current employment	Home-owner
Gloria	1	82	Female	Married	White	Retired	Teacher	Yes
Margaret	1	86	Female	Single	White	Part-time	Nursing	Yes
Katherine	1	74	Female	Divorced	White	Part-time	Secretarial	Yes
Roy	1	78	Male	Married	White	Part-time	Information technology/ Rowing coach	Yes
Corinne	1	75	Female	Married	White	Part-time	Priest	Yes
Yvonne	2	72	Female	Married	White	Retired	Systems analyst	Yes
Shelly	2	78	Female	Married	White	Retired	University staff	Yes
Bill	2	74	Male	Married	White	Retired	Healthcare project manager	Yes
Janet	2	72	Female	Married	White	Retired	Organisational development	Yes
Sylvia	3	79	Female	Divorced	White	Retired	Nursing	Yes
Irene	3	79	Female	Widowed	White	Retired	Teacher	Yes
Pauline	3	63	Female	Married	White	Part-time	Teaching assistant	Yes

used to engaging with online means of communication. Not all of the participants were used to Zoom so that we took time to get started and allowed participants to get used to the technology. There was one participant who was unable to join online and was supported by one of the researchers by telephone. So, whilst online focus groups can be an effective and efficient means of eliciting data among older people, it is possible that our focus groups did not include potential participants who may not feel comfortable with the group conversations online, and/or do not have access to the digital means.

Group interactions are not only important to elicit insightful data but observations of the interactions are data for analysis (Barbour, 2014). The focus groups were facilitated to enhance conversations between the participants as well as with the facilitator. There was attention given to the sensitivity of the topic as the Covid-19 pandemic had been a complex and difficult time for many people. The participants on the whole appeared to appreciate and gain from the opportunity to share their experiences and insights around the Covid-19 pandemic.

2.3. Analysis

Each focus group was audio recorded, anonymized and transcribed verbatim. The transcripts were then analyzed using thematic analysis (Braun and Clarke, 2006, 2022). Firstly, each focus group was listened back, and the transcripts were read through (accompanied with moderator notes from each focus group) to familiarize with the data and consider potential codes. Preliminary codes were made for each transcript with the research questions in consideration (Researchers GC and CB). The preliminary codes were then refined into a coding table to facilitate identification of themes (GC and CB). Themes were generated based on the salience and relevance to the research question. Each theme and the codes comprising the themes were reviewed by all authors before finalizing a set of themes which best describe the data.

Whilst there are debates about "saturation", a systematic review argued that saturation can be reached with small sample sizes (Hennink and Kaiser, 2022). Following the series of focus groups many of the key themes were evident across the focus groups and there was richness from the online group focused conversations and interactions. This paper can be described as not a total account of the experiences and perceptions of older people about their digital devices but has captured data from a diverse range of older people, at a certain time and in a particular place. The findings thereby provide important insights into the experiences and perceptions of ageing and the digital during and since the Covid-19 pandemic.

3. Results

Three interconnecting whilst analytically distinct themes around the meaning and experiences of using digital devices in everyday life during and since the pandemic, are thematically presented as: (1) Incorporating the digital into everyday life; (2) Social and digital connectivity; and (3) Challenges and limitations of the digital in everyday life. The themes were generated by an interrogation of the data that was informed by both the key research questions and the narratives generated amongst the participants.

3.1. Incorporating the digital into everyday life

At the start of the pandemic, the changes to the everyday routines and rhythms of the participants were significant. The participants described their vivid recollections of this time, it felt momentous within their lives. The public health messages and regulations limited movements, and were especially focused on older people, with several of the participants or their partners needing to shield, in which there was guidance to socially distance and to stay at home. Many of the

participants described this time with a sense "fear" and continual feelings of worry:

> there is always at the back of … especially at the beginning, was the fear (Gloria).

The taken-for-granted aspects of everyday had been challenged and the everydayness of routines and rhythms were questioned and became noticeable (Leder, 1990; Turner, 2004). The significance of everyday routines enables people to manage their sense of vulnerability, described by Giddens as "ontological security" (Giddens, 1991). Daily routines and norms can often be disrupted in the context of physical and social risks as people grow older, in this case, the pandemic represented a risk in which a sense of "ontological security" needed to be renegotiated (*cf.* Turner, 2004). The integrity and logic of the ageing body and daily routines were questioned and the taken-for-granted nature of embodiment and the rhythms of everyday life increasingly challenged. As the habitual and routinised rhythms of everyday life were disrupted, the participants were actively looking to develop new flows and rhythms in their daily lives:

> There's something about concentration, concentrate … being more aware of things … and being a bit more disciplined as well in a way, I think as an older person and a person … I'm … largely not regulated by going to work anymore and that sort of thing. So I think these … that having to look after ourselves better and being shut down and … throughout Covid, we had to be inventive and … and think about what we might do. (Corinne)

The extent to which the participants were influenced by their experiences of lockdown and social distancing was different. In particular, some participants needed to leave the home daily to engage in paid work. For example, one participant was a teaching assistant, and they were often going into the workplace, although the means of teaching during a pandemic required new digital skills:

> so I had to learn a lot then. Google Classrooms, I never want to see that again. (Pauline)

The pandemic not only resulted in a heightened sense of vulnerability but the everyday movements and mobilities of the participants were limited. Most of the participants were no longer able to freely meet others in-person outside their household. This is when the participants started to increase their use of digital technologies:

> But you are right, on the 22nd of March 2020, did I have any idea what something called Zoom or Teams were?! Didn't have a clue. (Sylvia)

Most of the participants increased their use of digital technologies, for some at first with a sense of reluctance until the realization that the pandemic was long term, and the purpose was to predominately maintain social connections and social activities. This included connections with family and friends, with the participants starting to change the ways they used digital technologies:

> But with … as regards communicating, we used to use Facetime all the time but then we wanted to start sharing things …. So my daughter set up a Zoom account which her children could use, so they could Zoom me and share things with me (laughing) on their screen, and so we got really into sharing screens and things. (Irene).

The participants used a range of devices including mobile / smart phones, laptops and computers and iPads. There was also a wide range and increasing use of a variety of means of communication and digital technologies that included social media, WhatsApp, Teams and Zoom to enhance sharing and communication with friends and family.

The participants also showed how they maintained contact with social groups and social activities. This included social connections and activities associated with the church, music and choirs, hobbies, learning activities, dieting, dance and exercise and also participating in paid work and volunteering:

> I was having some private … some French lessons outside U3A and the teacher adopted Zoom quite quickly. My Pilates class went on Zoom. I used Zoom socially with friends to keep up. (Janet)

As many events went online, some participants took the opportunity to engage with the arts that they may not have physically travelled to and therefore some new opportunities opened up:

> But digitally Edinburgh was fantastic because they did the Book Festival on-line, so we were able to listen to people who had probably never got … went up there, probably would not have even gone to see and discovered new authors and that, so that was good. (Gloria)

Participants talked about the importance of being together and passing shared time online whilst being in different spaces. They were often sharing and doing activities, such as playing cards, drinking wine or doing crafts. At times this eased the sense of isolation and the embodied doing and performing of an activity meant that conversations did not need to be continual but intermittent and from time to time as the participants shared an activity:

> And one of my friends, during the depths of lockdown, when we were getting a little bit challenged for things to do, we were doing sort of craft afternoons on Zoom. (Janet)

Other online activities were mainly done alone, such as online shopping, browsing online, playing games and reading. Some activities that were moved online were seen as useful and engaging, whilst other activities, such as, online jigsaws, and most activities around the choir and orchestra, were experienced as more problematic:

> Yeah, so we were all just basically singing to ourselves. We could hear him and what he was playing, but we could not hear each other, unless he said 'unmute' and then we could all talk to each other. But while we were singing it was very weird. (Pauline)

Adapting to social activities and connections online did take some time. The momentum online was described as different to face-to-face activities, as there was the need to adapt to using the technologies that included logging on, turning on videos, using the mute buttons, and way that online communications often work more effectively when

each person takes a turns to speak. In particular, the participants missed more intimate connections when in small groups or the momentum of conversations can occur in physical space, but is more limited in digital space:

> And that's really weird when you have got hundreds of people coming in and … you cannot sort of sit and chat to people like you can in a small group! (Pauline)

The experience and meaning of space were important, as many of these connections took place at a distance, in different spaces, but at the same time. The participants did at times compare how the difference in space from a shared physical building was to the experience online and the ways the activities changed and developed:

> I enjoyed all the work that I did during Covid, which was very different from being in a church building, to doing it on Zoom. (Corinne)

Boundaries around space can be drawn and re-drawn, for as Massey (1994) argues space does not have 'fixed' meaning, but instead meanings can be made and re-made in the spaces and moments the practices take place, as the digital, material and social relations intertwine and interconnect. Meaning around space can thereby change depending on context, as Goffman (1959) showed how our presentation of the embodied self can be performed differently depending on whether we are in spatial contexts considered as front or back spaces. In areas that are considered private (back stage), people often feel more relaxed and less concerned about their embodiment, whilst to engage with others can necessitate a more formal and public presentation (front stage) (*cf.* Peace, 2022). The visual nature of online connections blurs the boundaries between more private (back stage) and the more public (front stage) when presenting the embodied self:

> I mean at one time I used to be frightfully worried about you know how do you look and what … you know have I … should I put lipstick on or whatever? Now I … you know you … it's take me as you find me and that's it, so … I'm more relaxed about it now. (Katherine)

This was sometimes expressed as a more informal way to connect when within the more private space of the home:

> in a way it was quite handy because you did not have to get dressed up or … (laughing) … get anywhere or get so organized, you could just sort of like finish your dinner and just come into the next room, turn on … (Pauline)

There were differing views about moving from in-person to online deliveries for food shopping during the pandemic. As shopping for food was designated as an essential activity, there was the possibility of going to the supermarket in person, whilst socially distanced, or ordering online:

> At the beginning they offered us you know could they do anything, give us any food that we wanted or do any shopping. But … like other people have said, we had neighbours who would do it and I did carry on doing the shopping, very carefully, because I could. And I wasn't very good at doing shopping on-line. We live within sort of Sainsburys, Tesco's and Lidl's, within sort of four, five minutes, so I wasn't a very good bulk shopper because I knew I could just pop down and get something. (Gloria)

The decisions around shopping in person or online delivery involved their own sense of risk, the practicalities and everyday routines around shopping and social connections within the locality, such as, neighbours:

> because of lockdown, all our shopping is done on-line and she looks around at Tesco and Waitrose and etc., to see where the best buys are. The other thing is we … our neighbours on both sides were not shielding as much as us, and they went shopping for us, so we got to know our neighbours even better than we knew them, they are lovely neighbours anyway, but we got … I got to know them even better. (Roy)

At the time of the interviews, the United Kingdom had experienced three lockdowns, and there were the beginnings of the public health restrictions around social distancing being reduced, alongside a vaccination programme. The participants had started to meet in person for some social activities. At the same time, after the long period of time conducting activities online, the participants highlighted some of the perceived benefits of continuing with some digital connections, that included, being more efficient with time, fitting the activity around other routines, not needing to travel, and not having to go out in wet weather. Many participants described the possibility of social activities being more hybrid, in which people could choose to be online or in person, and this was considered in some contexts as a possibly more inclusive approach for older people:

> But as a church community, it did an awful lot for us because … and there are a lot of people who cannot come to church because they are disabled anyway, and it opened … it had a benefit in that people said, well if you … we started off by we recorded our services and then we put them on Facebook and our website to start with before we livestreamed and people said, well I can come to church now, which I never could before. (Corinne)

Participants also described how digital devices were used as a type of aide memoire. This included using the diary as a calendar and setting reminders about events and activities that needed to be recalled. The digital also became a memory device when trying to remember some information:

> And of course Google … Google is my best friend because I forget things and I can ask Google, she may not always give me the right answer but yeah(!) it gives me an idea. (Katherine)

During the Covid-19 pandemic the amount of digital technologies and devices therefore increased significantly.

> it's been forced on us and we have had to learn to do these things and realized there is a way of communicating when we cannot actually be together. (Pauline)

At a time when movements and mobilities were restricted the use of the digital provided meaningful moments and were mainly viewed as valuable and important.

3.2. Social and digital connectivity

Importance of connectivity, that is connections with family, partners, friends, social groups and the locality, as well as wider inter/national communities was expressed by the participants. During the Covid-19 pandemic these connections were predominately maintained virtually with people outside the household due to the public restrictions around movement and social distancing. Many narratives focused on communications and conversations with family, often adult children and grandchildren:

> we have got four children and nine grandchildren, so there's lots of conversations going on all the time when we could not see each other, I mean we had … a grandchild was born during Covid and we did not see him for ages and ages, so it was lovely to be able to Zoom call and Facetime with them. (Corinne)

Some of the participants talked about their caring responsibilities during the Covid-19 pandemic. Digital devices were central to maintaining connectivity for both the participants and the person being cared for:

> just as lockdown happened, my mother was in hospital, she's over 100 now, and she went into … permanently into a care home, and we got her a Facebook Portal, which has got an intelligent camera, so it focuses on the person speaking in the room. And this has been a godsend because also she's never used any IT whatsoever, she had a very basic mobile phone, and she just can say, hey Portal, call Bob or call Steph, or whatever, and so she can call up any member of the family, any time of day, when she chooses. (Roy)

The sense of time passing during the pandemic was evident from missing being in person around key events within the family, including, the birth of grandchildren, birthdays, Christmas, New Year and seeing grandchildren growing up:

> And you know I keep in touch with my daughter, I wasn't able to see her much, and my grandchildren, and I mean it's been amazing actually seeing how tall my grandson has got(!) you know from the age of thirteen to fifteen, he's just shot up and you know I almost do not recognize him when I do manage to see them for a weekend or something. (Katherine)

Whilst the participants were maintaining digital connections, the loss of in-person contact meant that aspects of the social interactions and embodied being-in-the-world were missed by being in different spaces with a screen as a boundary during their only means of communication for some time.

Participants often described ordering their everyday lives to enable enhanced connections with family and friends. This included during their daily routines by planning time to be connected online and also on special occasions, such as, Christmas:

> And at Christmas, when we could not meet up, we timed our Christmas dinner to all be at the same time and they set up, I think it was a Teams meeting, anyway, it came through on … I just had to click something and join their meeting and … and then we all had our Christmas dinner together! In our separate houses! Yeah, which was quite nice. (Irene)

Maintaining connections with family, friends and colleagues overseas was however complicated by different time zones that needed to considered:

> And one of our members has moved back to the States and so he, not every week, but he joins us, largely because the time difference, when he was working at home it was easier for that but … now he's back in the office it's not quite so regular but … that worked very well. (Roy)

Some means of communication were considered convenient and less intrusive as people did not have to be present at the same time. In this context WhatsApp was notably used more, for all types of communication, but also for fun, humour and sharing jokes:

> You know and people send … I think that was very uplifting at the beginning, we did send lots of little silly jokes and things and … they are very amusing, you know there's … especially when there's a disaster. I do not know why … I do not know how people manage to do it, but you know from some dreadful disaster, somebody makes some sort of joke which you know … I think it releases a tension, does not it. (Katherine)

There were many positive ways that the participants engaged with the digital to enhance their social connections and relationships, at the same time, interspersed through the focus groups, was the sense of loss of human and physical contact with others, often expressed as missing 'hugs':

> … it was that human contact and hugs that we missed terribly. (Sylvia)

Digital connections have an important purpose but do not replace the sense of being in the same place, at the same time, to have embodied co-presence, and to be in immediate and direct connection with others. The sensate and embodied experiences in everyday life were therefore described as significant:

> …there's just nothing really stands in for face to face contact, I think you pick up far more about, I do not know, just body language and … I know we are speaking and we can hear voice? but it's … I think it's just less empathic somehow. (Janet)

In this context, through the narratives, participants also described how the locality and their own neighbourhoods had taken on enhanced meaning and importance through the pandemic. This included using local space more, with or without digital technologies, and meeting more people in the public areas within their locality:

> and I discovered lots and lots of places locally that I'd never … I'd no idea they were there, and I mean they take me ten minutes to

> get there! So that's been … that's been really very interesting. (Katherine)

The pandemic also resulted in a period of reflection for many participants. In particular, about the importance of social connections and relations in their everyday lives:

> So although it was a really difficult and challenging time and we could not see each other face to face, it did have some … it taught us an awful lot about how we need to care for people and … and what people appreciated and those contacts were so important to the people who were … felt very bereft and on their own. (Corinne)

The disruptive changes from the pandemic resulted in an increased use of the digital in everyday life of the participants. Maintaining social and digital connections was important during this period of limited movements and social distancing. At the same time, the significance of embodied co-presence and the immediacy of shared space and/or time was highlighted.

3.3. Challenges and limitations of the digital in everyday life.

There were a number of concerns and limitations around incorporating more and more digital technologies into everyday life. First, not all older people were using digital technologies and participants expressed concerns of some older people feeling excluded. Second, possible issues around scams and privacy were highlighted. Third, participants expressed concerns about the move to more remote connections in health and social care.

Interspersed through the focus groups there were expressions of concerns for older people who were not participating in the online social activities. These interactions discussed how some older people may not feel comfortable with the technology, may be worried about not using digital technologies correctly or did not want or feel able to engage online:

> But these people who do have devices but they just will not connect into Zoom, just do not like the technology … But there's only about five or six of that seventeen who will actually use Zoom socially in that environment, which is so sad. (Shelly)

The resistance expressed by the participants was often within the context of being 'sad' as others may be missing out on social activities and connections. In particular, there were some groups within older people who may be at risk of becoming more socially isolated due to limited connections with the digital:

> I run a memory café for those with memory issues and dementia and loneliness, which had to stop obviously during Covid and it was quite difficult to … with people with those issues to keep contact. (Corinne)

It may also be that some older people do not have the technologies required or may need assistance in setting up or repairing digital technologies. One participant, for example, explained how for a long time at the start of the pandemic they had technological difficulties that they could not resolve until a younger relative was available:

> but what has been really difficult IT wise is that if you do not have … if you do not have anybody handy who can … who you can talk to about your IT issues and things, it … you can really get stuck. And … yeah, have a … have a big problem! …Well the … the battery went on the main mother board in my desktop and … it meant that every time I start … I started it, it had to … you know sort of boot up from scratch and everything. Eventually sorted out when my nephew came on a (laughs) one and only visit and he changed it for me. But I do have IT support, expensive IT support but … had a lot of problem with the printer. (Margaret)

Some participants described how communication on digital devices did not feel natural, and it can be difficult adapting to the momentum and online practices, to ensure good communication:

> if there's more than two of you, it's a little bit artificial because you are trying to take turns to speak and you worry about talking over people or not participating or whatever, you cannot sort of hug a Zoom image, there's just nothing really stands in for face to face contact. (Janet)

For others they did not feel confident and knowledgeable about digital and online practices and how to manage these in their daily lives:

> My one problem I do have is I'm not very good at you know with sort of e-mails and things like that, but I do not know if that's what you'd still call a digital world, but getting e-mails and documents and not knowing where to put them. (Katherine)

Many of the participants highlighted their worries about possible scams that seemed to increase as more and more are digitally engaged:

> it's just scam calls mostly, where you can … I'd say ninety nine times out of a hundred, you pick it up, it's somebody trying to sell you something… well I guess things like the e-mail scams, the text message scams, the ones that ask you to click when you have missed a delivery, there's a lot of publicity about things like that. (Pauline)

In particular, concerns were expressed about the risk to data and their own privacy with an enhanced sense of vulnerability about who and which communications to trust.

The key concern that the participants highlighted however was the move to more remote means of communications within health and social care during and since the pandemic. This involved less face-to-face appointments with health and social care and instead included aspects of e-health, emails, online calls, texting and emailing, and telephone calls. For some participants the changes had been experienced as effective and efficient:

> honestly it was so easy! And he was able to say immediately, I agree with what you said … because I'd already said to him, I think you know this is what it is, and he said, OK fine, he said, just send me a photo, and he agreed, and I was able to go down to the chemist that afternoon and collect my prescription … (Sylvia)

For many participants there was instead a sense of frustration about not being able to connect with health and social care staff in person. Awaiting a zoom or telephone call meant a lot of time waiting just in case, as the timings were often not pre-scheduled. In particular, there was a sense that something might be missed by not being in the same space, at the same time, as the health professionals:

> I do not know, it's just something about being in the same room as the doctor, is not there, that you just … just that feeling that he is, or she is seeing you as actually … you really are, and might pick up things about your condition that they do not see online, that … there's just that feeling. (Roy)

The importance of embodied co-presence was especially heightened in the context of health and social care staff. This was due to the importance of the sensate and bodily when the participant had queries about their health and wellbeing. If there was a screen mediating online calls, the need to explain symptoms on the telephone and/or to send a photograph online there was a distance and sense of remoteness in the communication and this appeared to result in an increased sense of vulnerability and questions around trust:

> whatever you want to have looked at, and I feel like there's something about … you know like if you look at a photograph of something, you do not always get like the texture of whatever it is you are looking at, whereas in person and … you know especially if you are looking at something that's raised on your skin or whatever. (Irene)

For many participants there were not only issues around using technologies in the context of intimate and personal health concerns, when the participant was already worried and concerned, but providing information and results remotely, the meaning was not always understood:

> but it's quite difficult to find what you are looking for and to … and also to understand the way they present the results, unless you are a professional, you know, I have to get my daughter to come round and look at it and say, what does this mean, you know?! It's not very intuitive, it's not very user-friendly I do not think. (Roy)

Whilst there were many positive experiences and meanings around the increased use of digital technologies in everyday life, there were also exclusions, concerns and vulnerabilities that were experienced and/or observed by the participants. This was especially evident in the use of the digital in the context of health and social care.

4. Conclusion

The use of digital technologies and devices increased during and since the pandemic among this sample of older people. The meaning and experiences of digital devices within the narratives are portrayed and contextualized around their own experiences and rhythms of the pandemic. Whilst at the start of the pandemic some participants were initially reluctant about increasing the use of the digital in everyday life, the use, purpose and variety of digital devices increased significantly during and since the Covid-19 pandemic.

Digital devices were viewed as beneficial for maintaining social relationships, social connections, social activities and hobbies, and as a means to organize daily routines as well as an aide memoir. Participants talked about using the digital within wider narratives associated with the pandemic in which daily routines and habits were significantly changed and everyday social contacts outside the household had been lost. The digital was incorporated into their everyday lives as the participants developed new and different rhythms and flows in the context of the wider rhythms of the pandemic (*cf.* Lyon, 2019). Time and space were further interwoven into the narratives and meaning around digital technologies, in which the boundaries around space were continually made and re-made (*cf.* Massey, 1994). In this context the digital provided meaningful moments within the everyday lives of older people and was mainly viewed as valuable and important.

At the same time, digital devices were not viewed as a direct replacement for face-to-face connections and the time during the pandemic highlighted the significance of embodied co-presence. This was notable for older people living alone who lived alone and/or described limited social contacts. Participants also voiced concerns around the risk of scams and privacy and surveillance issues. Of particular note, the changing nature of communications within health and social care was salient, especially the increasing move to remote communications and the loss of face-to-face contacts. In many ways, there was a distinction within the narratives between familiar and localised connections of family and friends and the increasing use of the digital in the health and social care that is expressed in more fearful and vulnerable ways and experienced as depersonalised and disembodied. The nature of the social and embodied connections was therefore meaningful to the participants as well as the space and place in which these occur. As the participants now widen their social contacts post-pandemic, the importance of developing a balance between the use of online and digital means of communication and meeting face-to-face and in person was also highlighted.

Buse (2010) highlighted the ways that narratives of ageing whilst complex often draw upon ideas around the competence of youth and the digital in which there are hierarchies between young and old bodies are reproduced. Within the narratives of the participants there were at times distinctions between young and old around knowledge and expertise of using digital technologies. Discussions around the use of the digital as an aide memoire were often described to mediate a perceived vulnerability around the possibility of being forgetful, rather than a more youthful notion of promoting productivity. The sense of vulnerability and risky old bodies was also evident through the narratives around ageing and the digital. In this context, the narratives reveal how society can naturalise the double standard for the same usage of digital technology between young and old that has possible implications for ageism.

As the research was conducted during the period of the pandemic, when in-person research was restricted, the data was collected online and remotely. There were benefits of this approach and the participants enjoyed the opportunity to reflect on and discuss their experiences online and interactions between participants were engaging. At the same time, other possible participants may have been dissuaded by the

remote method of collecting data online. In particular, narratives of older people who did not engage with online social connections and increased their use of digital technologies may be missing. The research presented in this paper can therefore be seen as an account of the experiences and meaning among a diverse group of people, at a certain time and place. The richness of the data has provided important insights into the meaning and experiences of the increasing use of digital devices and technologies during and since the Covid-19 pandemic. Further research that diversifies the sample of older people and includes in-person as well as online data collection would however be fruitful.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by College of Health, Medicine and Life Sciences Research Ethics Committee, Brunel University London. Reference: 30547-LR-Dec/2021-36960-1. The patients/participants provided their written informed consent to participate in this study.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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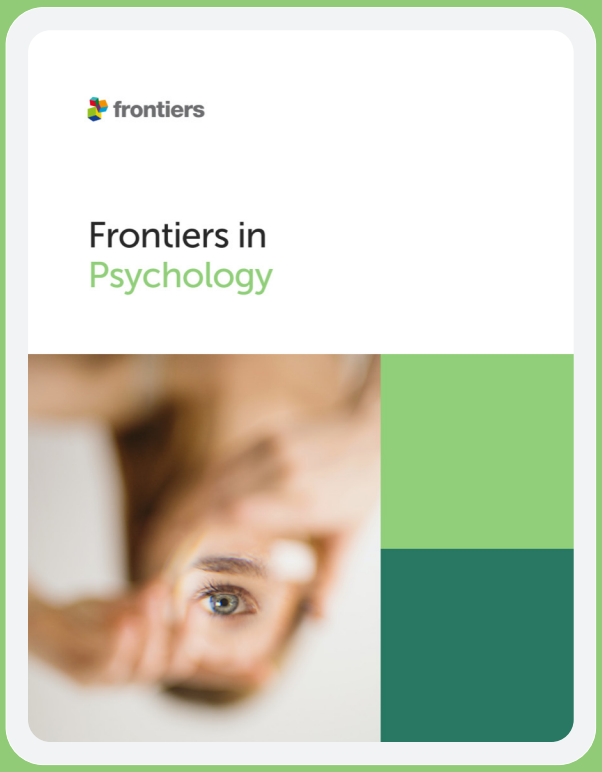

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