Digital Social Interaction in Older Adults During the COVID-19 Pandemic

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Throughout the COVID-19 pandemic, older adults have been encouraged to stay indoors and isolated, leading to potential disruptions in their social activities and interpersonal relationships. This interview study ($N = 24$) provides a close examination of older adults' communication technology adoption and usage in light of the pandemic. Our interviews revealed that the pandemic motivated many older adults to learn new technology and become more tech-savvy in an effort to stay connected with others. However, older adults also reported challenges related to the pandemic that were major impediments to technology adoption. These were: (1) lack of access to in-person technology support under physical distancing mandates, (2) lack of opportunities for online participation due to negative age stereotypes and assumptions, and (3) increased apprehension to seek help from family members and friends who were suffering from pandemic-related stresses. This study extends technology adoption literature and contributes an up-to-date examination of the "grey digital divide" (the gap between older adults who use technology and those who do not). Our findings demonstrate that despite the rapidly increasing number of tech-savvy seniors, a digital divide not only persists, but has been exacerbated by the transition to virtual-only offerings. We reveal the challenges and coping strategies of older adults who remain separated from technology and propose actionable solutions to increase digital access during the COVID-19 pandemic and beyond.

CCS Concepts: • **Human-centered computing**; • **Collaborative and social computing**;

Additional Key Words and Phrases: COVID-19, pandemic, older adults, aging, technology adoption, communication technology, digital divide

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1 INTRODUCTION

Older adults (people ages 65+) worldwide are physically isolated in their homes due to COVID-19 related physical distancing guidelines and orders to shelter-in-place. Compared to the general population, public health authorities have mandated stricter distancing orders for older adults due to their increased risk of severe illness from COVID-19 [24]. These include limiting in-person contact and avoiding gatherings in crowded or enclosed settings. Consequently, many older adults

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are presently separated from their communities and are at high risk of feeling lonely and socially isolated [74].

In an effort to reduce social isolation in older adults who are sheltering-in-place, a variety of organizations have mobilized virtual alternatives to everyday activities that can no longer operate in-person. Some examples include: digital social events, online fitness classes, and telehealth services. Given the steadily increasing rates of Internet use and smartphone adoption in the aging population [3], these solutions could potentially reach and benefit many older adults. A significant problem, however, is that despite the increase in technology users, a large proportion of older adults remain separated from technology either by choice or by lack of access [25, 46, 61]. Issues regarding digital inequalities are further exacerbated by the fact that many COVID-19 related interventions for older adults are being delivered through newer platforms, such as Zoom, which may be unfamiliar and difficult to navigate, even for experienced technology users.

Despite these obstacles, life-altering circumstances, such as a pandemic, may be a powerful motivational force for technology adoption. This has been shown in a number of HCI studies, which have demonstrated that major life events (e.g., war [55], a residential move [72], remote weddings [56]), are key moments for technology adoption. However, the COVID-19 pandemic differs in several major ways to those of other events previously described. The pandemic, for example, required physical distancing and lockdowns as a prerequisite to slow the spread of the virus. This, in turn, accelerated the transition of in-person activities towards online-only services and interactions. It is possible that these changes may have motivated older adults to adopt and expand their use of technology. In line with this thought, many researchers and journalists have speculated that the pandemic could help narrow the "grey digital divide" (the disparity regarding online connectivity and technology use among older adults) by motivating technology adoption (e.g., [17, 60, 66]). However, there are also concerns that some older individuals who have little to no experience with technology to begin with may be left behind in this digital revolution [6, 70]. Currently, there is a scarcity of data to address these speculations. Our study aims to fill this crucial gap.

We interviewed 24 older adults with varying backgrounds and life experiences to identify pandemic-related motivations and barriers to technology adoption and to understand how the rapid digitization of everyday life impacted the grey digital divide. Our primary findings were that:

- restrictions on face-to-face social interaction pushed many older adults to **adopt new technologies** and **become more tech-savvy**
- the pandemic surfaced **new barriers to technology adoption**, such as restricted access to in-person technology support under physical distancing mandates and a lack of opportunities for digital participation due to age-based discrimination
- although the pandemic **heightened feelings of digital exclusion** among non-users, they were able to **adapt to their new life circumstances** by socializing through non-digital means, staying busy with hobbies, and by relying on tech-savvy "proxies"

This work makes three primary contributions to CSCW. First, we provide fresh insights into older adults' technology adoption and communication practices in the context of the COVID-19 pandemic. Specifically, we highlight pandemic-related motivations and barriers to technology adoption and describe the diverse experiences of older adults as they adapted to the digital surge that accompanied physical distancing norms and lockdowns. Second, we contribute an up-to-date examination of the grey digital divide in light of the society-wide shift towards online ways of life. Finally, we provide suggestions to address aforementioned challenges for greater inclusion of older adults into the digital space.

2 RELATED WORK

This study builds on past research on the grey digital divide and technology adoption, and contributes to advancing literature on COVID-19 and it's impact on older adults.

2.1 The grey digital divide and technology adoption

A large body of research has demonstrated a "grey digital divide" (or "grey divide" for short) where older adults are less involved with technology than younger adults. The term "digital divide" not only describes the gap between technology users and non-users, but also subtle gradations of digital exclusion— for instance, discrepancies in levels of digital literacy and experience. Although technology use (e.g., Internet usage, smartphone adoption) is steadily increasing among the older population [3], age continues to have a significant differentiating effect when it comes to technology adoption and skill— particularly in the oldest age brackets [25, 37, 73]. In a recent study, Pang et al. demonstrated that despite overall gains in digital literacy, many seniors rely on others (e.g., store technicians, younger family members) for technology set-up and onboarding [63].

Increasing digital access for older adults and bridging the grey divide has been a focus for many researchers in CSCW and in the broader HCI community. In particular, a large body of literature has been dedicated to investigating how technology can be designed to be more accessible for people with specific age-related impairments, such as late-life vision loss [9, 10, 43, 65] and dementia [39]. Other studies have targeted a more general older adult population and have focused on providing solutions to overcome barriers to digital literacy (e.g., [16, 75]). Along with these efforts to bridge the grey divide, a growing body of work has demonstrated the diverse needs, opinions, and preferences of older adults relating to technology adoption, such as their values related to social media [36], reasons for distrusting technology [45], and learning preferences [50, 63]. Collectively, these studies underscore the complexity of technology acceptance and highlight how older adults' individual values and life circumstances impact their decisions about technology.

Older adults who remain on the "wrong" side of the grey divide may be facing challenging realities during the COVID-19 pandemic due to their inability to access online services and participate in digital social events. Our work provides up-to-date insights on the grey divide, highlights issues to be resolved, and proposes actionable solutions to improve digital access for older adults who are currently isolated and excluded from the online world.

2.2 Technology to support social interaction for older adults

Maintaining meaningful relationships is a critical component of aging well. However, as people get older, their social circles tend to shrink due to age-related changes, such as retirement, bereavement, and declines in health [18, 85]. Consequently, compared to younger age groups, older adults are more likely to experience feelings of loneliness and social isolation [64]. To address this problem, aged care providers and HCI researchers are increasingly exploring the use of communication technologies to help people remain socially connected as they age.

A number of studies have demonstrated the positive effects of technology on reducing feelings of social isolation, enhancing older adults' social lives, and improving their overall well-being (e.g., [28, 41, 42]). Communication technologies can help facilitate social activity in older adults by helping them overcome barriers to connectivity, such as geographical distance and mobility impairments, and can help them feel less lonely even if in-person contact is infrequent [15, 19, 67]. Video calling, in particular, can enable rich communication experiences between older adults and their long-distance family members and can garner a sense of "being there" with them [1].

The benefits of communication technologies are even more pronounced during times of isolation and physical distancing, such as the COVID-19 pandemic. Communication outlets, such as the

computer or smart devices, can provide avenues for older adults to stay engaged with their communities (e.g., places of worship, community centres, fitness classes), family members, and friends while following physical distancing recommendations. In past studies, however, older adults have articulated some concerns regarding the use of technology for social interaction, such as the loss of deeper communication and the time commitment required for online participation [36]. To the best of our knowledge, none of the previous studies were conducted in the context of a pandemic where in-person interactions were not possible.

2.3 Existing articles on COVID-19 and older adults' technology practices

Due to their increased risk for severe illness with COVID-19, many older adults are sheltering-in-place and maintaining physical distance from others. Existing studies on older adults and COVID-19 have typically focused on the potential health consequences of social isolation, which includes impairments in daily functioning and declines in mental health and cognition [7, 47, 86].

Communication technologies may help mitigate aforementioned risks by providing isolated older adults with opportunities for social interaction. In fact, according a recent news article, members of a seniors group in New York City were able to learn Zoom and lead socially active lives while in quarantine [23]. It is important to note, however, that these individuals were supported by a number of staff who provided one-to-one technology training and weekly check-in calls. Similar services may not be available for the broader older adult population. People who are unable to access technology during this time may struggle with the "double burden of social and digital exclusion" [70]. That is, in addition to feelings of exclusion from a digitally dominated society, the focus on digital events as the primary means of social interaction could also lead to feelings of social exclusion among those who are unable to participate online.

The majority of studies investigating older adults' technology practices during the COVID-19 pandemic have typically involved statistical analyses of large-scale survey data (e.g., [68, 83]) or have been opinion editorials (e.g., [4, 60]). There has been a lesser focus on examining individual experiences. Our study aims to fill this gap by contributing qualitative insights on older adults' communication technology practices during the pandemic and their challenges related to technology adoption and digital exclusion.

3 METHODS

The goal of our study was to explore older adults' adoption and use of social technologies during the COVID-19 pandemic. We gathered qualitative data through semi-structured interviews, and analyzed this data inductively using the constant comparative method. This method is often associated with Glaser and Strauss' classic Grounded Theory (GT) approach [32]. Similar to classic GT studies, data collection and data analysis occurred in an iterative fashion: we conducted interviews in batches of six and analyzed those interviews before recruiting the next batch of participants. Based on the analysis of each batch, we refined and extended the interview guide as needed.

Notably, our methodological approach deviated from GT in that our goal was not to generate a theory. Rather, we utilized analysis procedures associated with GT to systematically uncover the patterns in our data without the imposition of a predetermined framework or theory. Similar methodological processes have been used in a number of past CSCW studies (e.g., [2, 53, 84]).

Table 1. Participant demographics and self-reported technology use

ID	Age	Gender	Highest form of education	Household composition	Self-reported tech-savviness	Communication technologies used during the pandemic
P1	82	Man	College degree	Alone	Low/Intermediate	Telephone, texting, email, **Zoom***, **Twitch***
P2	67	Woman	Postgraduate degree	With spouse	Intermediate/Advanced	Telephone, texting, email, FaceTime, Skype, Zoom
P3	73	Woman	College degree	With spouse	Low/Intermediate	Telephone, texting, email, Facebook, FaceTime, **Zoom***, **YouTube live streaming***
P4	81	Man	Postgraduate degree	Alone	Advanced	Telephone, texting, email, Facebook, FaceTime, **Zoom***
P5	81	Woman	High school or less	Alone	Intermediate/Advanced	Telephone, texting, email, Facebook, Twitter
P6	78	Woman	Prefer not to answer	With spouse	Low/Intermediate	Telephone, email, FaceTime, **Zoom***
P7	75	Man	College degree	With spouse	Low	Telephone, texting, email, Facebook
P8	76	Woman	Postgraduate degree	With spouse	Low/Intermediate	Telephone, texting, email, FaceTime, **Zoom***, **webinar software***
P9	75	Woman	Some college	Multigenerational	Low/Intermediate	Telephone, email, WhatsApp, **Zoom***
P10	70	Woman	College degree	With partner	Low/Intermediate	Telephone, texting, email, **FaceTime***, **Zoom***
P11	79	Man	Postgraduate degree	Multigenerational	Intermediate	Telephone, email, **FaceTime***, **Zoom***
P12	74	Woman	College degree	Alone	Low	Telephone
P13	73	Man	College degree	Alone	Intermediate	Telephone, email, **FaceTime***, **Zoom***
P14	66	Man	Some college	With partner	Intermediate/Advanced	Telephone, email, Facebook, Instagram
P15	67	Woman	Postgraduate degree	Alone	Intermediate/Advanced	Telephone, texting, email, WhatsApp, FaceTime, **Zoom***
P16	77	Man	College degree	Alone	Low	Telephone, email
P17	71	Woman	Postgraduate degree	With spouse	Low/Intermediate	Telephone, email, Facebook, **FaceTime***, Skype, **Zoom***
P18	74	Man	High school or less	With spouse	Low	Telephone
P19	81	Man	College degree	Alone	Low/Intermediate	Telephone, email, **WhatsApp***, **Zoom***
P20	71	Woman	Postgraduate degree	Alone	Low/Intermediate	Telephone, Instagram, Skype, **FaceTime***, **Zoom***
P21	77	Man	College degree	With spouse	Intermediate	Telephone, texting, email, FaceTime
P22	69	Woman	College degree	Alone	Intermediate	Telephone, texting, email, Facebook, **Zoom***
P23	79	Man	Postgraduate degree	With spouse	Advanced	Telephone, texting, email, **Zoom***, **Webex***
P24	78	Woman	Some college	With grandchild	Intermediate	Telephone, texting, email, **WhatsApp***, **Skype***, **Google Hangouts***, **Zoom***

* Indicates that the technology was newly adopted during the pandemic

3.1 Participants and recruitment protocol

Our participants were 24 older adults (13 women, 11 men) living in British Columbia, Canada. The age of the participants ranged from 66 to 82 years (M=74.8 years, SD=4.8 years). We used purposive sampling to obtain variation in age, gender, education, and household composition. These sociodemographic factors are often associated with technology use [3, 20, 81]. The details of participants' demographics can be found in Table 1.

The majority of participants (13) lived with a spouse or partner. Two participants were from a multi-generational household (i.e., more than two generations living under the same roof) and 11 lived alone. Two participants worked part-time, while the remaining twenty-two were retired. Their past occupations included: nurse, tutor, teacher, professor, professional musician, engineer, welder, self-employed, periodontist, sales person, social worker, camera operator, office manager, project manager, underwriter, marina owner, director of quality insurance, director of a seniors complex. We note that all interviewees lived independently in their own homes and managed day-to-day life without the assistance of homecare or similar services. We recruited participants by reaching out to personal contacts, local retirement communities, seniors' groups, and through snowball sampling. The recruitment flyer focused on attracting participants who were interested in sharing their pandemic-related experiences and those who desired assistance with technology. The compensation for the study was a choice between (1) a $25 honorarium or (2) a 1-hour technology support session with the researcher after the interview. Eighteen participants selected option 1 and six participants opted for the latter.

We collected demographics data, such as the participants' age and gender, through an online survey (available in supplementary materials). Some participants completed this survey on their own before the interview while others (e.g., participants who were unable to access the survey online) completed it verbally with the interviewer at the start of the session. In addition to questions regarding demographics, the survey also contained questions about technical proficiency (e.g., In your opinion, how "tech-savvy" are you and why?; Do you regularly use technology for communication?).

3.2 Data collection through semi-structured interviews

We used a semi-structured interview format so that participants could freely elaborate on their experiences and take part in shaping the conversation. Due to the circumstances of the COVID-19 pandemic, these interviews were entirely remote. Each interview lasted approximately one hour and was conducted through the Internet or over phone by the first and second author from May to August, 2020. To extend the reach of our study, we encouraged participants to choose their preferred method of (remote) communication for the interview. In total, nine participants were interviewed through Zoom, 14 by phone, and one participant was interviewed asynchronously through text messages. A set of prepared questions was used to guide the interview session. These questions were revised prior to the first interview based on two pilot studies (the revised interview questions are available in the supplementary materials).

The interview protocol included questions about participants' experience with technology, their social lives, and their technology use during the pandemic. These topics often naturally raised discussions regarding specific platforms (e.g., Facebook, FaceTime, Zoom) and different types of online activities (e.g., live-streamed religious services, webinars, virtual book clubs). All interviews were conducted in English, audio-taped with participants' permission, and transcribed verbatim for coding purposes.

3.3 Data analysis using the constant comparative method

We analyzed the interview transcripts using the constant comparative method, which is a data-analytic process that was introduced by Glaser and Strauss. As its name suggests, this method involves comparing each interpretation and finding with existing findings. Following the stages outlined by Glaser [31], we first conducted open coding on each interview transcript by assigning initial codes, such as *new digital routines* and *social pressure*, for segments of data to summarize what was going on. We iteratively refined these codes through constant comparison with the raw data (i.e., interview transcripts), other codes, and emerging themes, resulting in over 200 open codes. Throughout the analysis process, we grouped together conceptually similar codes to form high-level categories, such as *motivators for going online* and *sources of tech-support*. We formed 25 categories in total. The codes and categories are available in the supplementary materials.

Between interviews, the research team had frequent meetings to discuss the codes and emerging findings. The coding process was collaborative and transparent, meaning that each researcher could see and comment on another researcher's codes. We continued to recruit participants and schedule interviews until we reached thematic saturation.

4 FINDINGS

First, we provide a contextualizing overview of participants' communication technology practices during the pandemic, including their self-reported technology proficiency, frequency of technology use, and the specific applications that were adopted. We then report our key findings, which involve (1) how the pandemic increased participants' motivation to learn technology, (2) major impediments to technology adoption, and (3) the effects of the pandemic on the grey divide.

4.1 Communication technology practices during the pandemic

All 24 participants reported using technology during the lockdown for social interaction purposes. Some participants were sophisticated users of modern technologies, such as Facebook and Zoom, while others preferred "traditional" methods, such as phone calls or email. Sixteen participants reported that they learned how to use at least one new communication technology during the pandemic. These included: (1) video chat applications (such as FaceTime and Zoom), (2) live streaming services (such as Twitch and YouTube live streaming), (3) webinar software, and (4) instant messaging apps (such as WhatsApp). With regard to frequency of use, 22 participants stated that their technology use increased substantially during the pandemic. The remaining two reported no noticeable change. For a detailed breakdown of participants' communication technology practices, refer to Table 1.

4.2 How did the pandemic motivate technology adoption?

Here, we describe two pandemic-related factors that motivated older adults to adopt technology for social interaction purposes.

4.2.1 Technology was often the only option for social interaction among strict adherers of self-isolation measures. Participants who strictly followed pandemic guidelines to self-isolate and "shelter-in-place" were highly motivated to explore new digital communication platforms because, in most cases, technology was their only opportunity for social interaction. Strict adherers of COVID-19 guidelines were typically individuals who were immune-compromised (P5, P19), living with someone who was immune-compromised (P8), and those who were simply very concerned about the virus (P3). As an example, P19, an 81-year old who did not leave his home due to a "compromised lung situation" was motivated by his new life circumstances to learn Zoom so that he could "see faces once in a while". At the time of the interview, P19 was also in the process of learning how to

use WhatsApp, an instant messaging application, so that he could participate in group conversations with his children who could no longer come over to visit. Similarly, another participant compensated for the lack of face-to-face interactions and in-person activities by socializing digitally all day:

> "Because I'm 80, I have to be careful and my friends are getting up there too. So we just feel as though we should be cautious for a while. Now, this phone beeps all the time. The emails come all the time. The texting comes all the time!" (P5)

Isolated older adults who successfully adopted new communication platforms during the pandemic often reported that digital social activities were now a standard part of their daily routine. In fact, many participants spent multiple hours everyday engaging in these activities, and one participant even stated, "Zoom and I are best friends" (P22).

4.2.2 Older adults who were highly connected prior to lockdown missed social interaction. Fifteen participants reported that they learned new technology, such as Zoom and FaceTime, in order to remain engaged with their family, friends, and community. This motivation was particularly notable in individuals who had large interpersonal networks or who were highly involved in their social groups (e.g., church, book clubs, sports groups) prior to the lockdown. In fact, for many participants, these social commitments were an essential part of their lives, and in some cases, fundamental to their identity. For example, P3 stated, "There's Tai Chi on Monday, Tuesday, Wednesday—I used to go to all of those", and similarly P9 stated, "Singing and ringing [church bells]—that's my life". When these social groups and communities transitioned online, participants were willing and eager to "jump in right away" (P10). P9 explained:

> "Well I *had* to learn Zoom because of my [church bell] ringing group. We rang up to six hours a week. That's a huge part of my social life. The pandemic left a huge hole, an absolutely huge hole when it happened. But Zoom is an opportunity to keep in contact with them."

It is important to note, however, that there were some participants who were not willing or motivated to adopt new technology, despite the reduced opportunities for social interaction. These were people who were typically less social and accustomed to spending time alone. This is exemplified in the following quote from P18, a self-described "loner":

> "I hate to say this, but I don't have much of a social life [...] I have no desire to learn any of it [technology]. It has no impact on me. There's no need for it for me."

Similarly, another participant echoed P18's sentiment:

> "What's the point of us struggling to try and learn these things? For what? To make a few communications? Nah, it's not worth it [...] Technology to me is just a pain in the butt." (P7)

4.3 How did the pandemic hinder technology adoption?

Next, we describe three barriers related to the pandemic that were major impediments to older adults' technology adoption and participation in online social activities.

4.3.1 Ageism became visible and led to digital exclusion. When describing their online experiences during the pandemic, several participants alluded to the topic of ageism (the stereotyping, prejudice, and discrimination against older adults and their age-related changes [12]). Two participants, P1 and P6, observed ageist attitudes from various activity hosts who assumed that older people were either uninterested or incapable of participating online. In some cases, these assumptions led to the digital exclusion of older individuals, including those who were "sharp" (P1) and "ready to come

[online] and learn" (P6). In fact, many older adults were not even invited to participate in online activities in the first place:

> "Out of the 40 people in the meeting, the organizers assumed that around 10 people would be too old to use Zoom, so they gave up on them. They [the organizers] didn't even try to give them the instructions. They didn't bother because they thought it was beyond their reach." (P1)

Similarly, P6, who belonged to a local senior's education group, noted that the leadership were apprehensive to transition courses to online platforms because they assumed that "a lot of elderly do not have the competency to do it online". P6 expressed her frustrations in the following statement:

> "I'm all against ageism. We *are* capable of learning. Sometimes it's just a different type of learning and I think people need to respect that. We can't be overly negative about seniors, and these programs should allow us to do more online."

To our surprise, the very people who expressed ageist sentiments were often older adults themselves. For instance, there were older adults in P1's seniors leadership group who labelled other participants as "slow" and assumed that they were uninterested in learning technology:

> "The other elder who is initiating these meetings said that there's around 15 people who aren't participating because they're not only slow with technology, but they are slow at walking, slow with a lot of things [...] He says because they are so old, they won't try it—they won't even think about trying it."

4.3.2 Pandemic bubbles were often the only source of in-person technical support. During the early stages of the pandemic, public health authorities encouraged people to form small social "bubbles" to help them cope with the restrictions of the pandemic. These typically consisted of a few family members and friends who had a mutual agreement to limit their contact to the individuals in the same group. For many participants, their pandemic bubble was not only their sole source of face-to-face social interaction, but also the only way they could receive in-person technology support. Other in-person resources, such as electronics retailers and community centres, were closed or difficult to access due to high call demands and limited staff. One participant, who lived alone and only had one friend in her bubble who was also not very skilled with technology, expressed a sense of helplessness when it came to learning and troubleshooting technology during the pandemic. She explained:

> "Things are obviously different because you can't just go to the shop or have someone come over to repair things anymore. Everyone's busy with their own life right now and it's just not right to ask someone to risk their health for my benefit." (P12)

In contrast, P6 successfully adopted a variety of new technologies because she had someone in her bubble who could come over and help her out:

> "My brother-in-law he is in our bubble [...] he is our computer whiz, so we've had that specialty with us. It's been really good. We've both had some private tutoring when he comes over for dinner and we trust the three of us are a unit."

Many participants, particularly those who were new or novice technology users, either needed or preferred in-person assistance when learning technology. Participants preferred in-person approaches because it was more convenient (P1, P9, P18, P20, P21, P22), fast (P9, P11, P19), and because there was very little chance of miscommunication (P1, P6, P12). When we probed participants on other learning methods, such as printed instructions, online manuals, video tutorials, or receiving help over the phone, these were generally deemed time-consuming (P9, P11), prone to error (P9, P12), overwhelming (P10, P13, P16, P24), or simply "not human enough" (P6). In regard to online

learning resources, one participant, P13, alluded to the notion of a "technical support paradox": where it is impossible to teach technology through technology to someone who does not know how to use technology. As an example, he explained: "An online course doesn't help much if you can't get online in the first place".

4.3.3 Technology challenges seemed trivial compared to younger generations' pandemic-related stresses. Two participants, P14 and P19, thought that their younger family members and friends were going through immense stress due to the pandemic and should not be burdened with their technology problems. These participants discussed burden in relation to not wanting to "waste" their children's time (P19) and were concerned that younger generations were disproportionately impacted by the pandemic and suffering more than any other generation (P14). For example, P19 spoke about his children who were struggling with economic losses and career hardships due to the pandemic; these were "serious problems" much more important than his technology challenges, which he described as "non-essential" and "more of a luxury than anything". Although P19 had a keen desire to expand his technology skills so that he could "do the more complicated stuff", such as hosting his own Zoom meetings, he was uncomfortable with the idea of asking his children for help:

> "I've got nobody to teach me [...] I have children, but they're so busy. All this COVID stuff has been a real stress for them, their careers, you know? They don't actually have the time to tell me too much. So even though my life has slowed down, it's been the opposite for them. Chaos. Utter chaos."

Similarly, P14 stated that the pandemic was "not a good time" to be seeking technology-related favours from his younger friends. He explained:

> "Being retired, it's quite different. I don't have to worry about losing my job or my income. I don't have any of those worries. But my close younger friends are having a hard time. [...] So for setting up systems and things, I have friends I can call. They would do their best to explain it for me and look after it, but now's not a good time for that."

4.4 The impact of the pandemic on the grey divide

Our findings demonstrate that although the pandemic motivated many older adults to adopt technology and become more tech-savvy, it also exacerbated the marginalization of non-users. Here, we contrast the experiences of older adults who successfully crossed the divide (i.e., those who gained or improved their technology skills and were able to connect online) with those who remained on the "wrong" side. We also describe the coping strategies of non-users as they adapted to the their new life circumstances under the pandemic.

4.4.1 Many older adults crossed the divide and became savvy technology users. The COVID-19 pandemic was a strong motivational force for technology adoption for the majority of our participants. Notably, for several individuals who had very limited experience with technology pre-COVID, the pandemic was the necessary push to "cross" the digital divide—to step out of their comfort zone, explore new technologies, and gain new digital skills. In fact, one participant, P1, explained that he never would have tried videoconferencing if not for the pandemic. Videoconferencing made a "tremendous impact" on P1's life by allowing him to see his children throughout the lockdown, and this impact motivated him to expand his digital repertoire even further. He stated, "For a while I didn't want to touch anything other than the Internet and telephoning somebody. But now, I want to learn too".

Three participants (P1, P10, P13) who engaged in online social activities for the first time during the pandemic, reported that they were eager to continue their online participation even after the pandemic was over. For example, P10 said, "I think even after we can go in normally—or relatively normally whenever that's going to be, I think I would still do some classes online". These participants enjoyed the convenience of online participation and were excited by the prospects of being able to connect with their remote family members more frequently.

One notable challenge associated with the sudden and rapid influx of technology adoption among new and novice users was that virtual activities were frequently disturbed by technical difficulties (e.g., participants forgetting to turn on the microphone when speaking or accidentally leaving the meeting partway through). Over time, however, participants became savvier with technology and online experiences ran smoothly:

> "Initially it was very funny actually, because all kinds of silly things were happening. But now we're pretty savvy. We don't need somebody there holding our hand and saying 'do this, do that'. We can do it on our own."

4.4.2 Older adults on the "wrong" side of the divide felt frustrated, anxious, and alienated. Participants who either did not use the Internet (P12, P18) or used it very minimally (P7, P16) felt disconnected from their communities and acknowledged that they were missing out on valuable social interaction opportunities. For example, P16 stated, "I'm not really in touch—I haven't been since the COVID thing started", and similarly, P18 said, "Everyone's doing Zoom—but I don't do Zoom". Some participants had a genuine interest in learning technology but were frustrated by the steep learning curve, past failures, and by their general lack of experience. To our surprise, however, these participants rarely chose technology support as their preferred choice for compensation. P12 believed she was "too far behind to catch up", and another participant explained, "I probably wouldn't be able to follow the steps. It's never been me who had to set these things up" (P19).

Two participants (P7, P18) explicitly indicated that they had no desire to learn technology. For example, P7 referred to the pandemic as a "technological nightmare" and refused to conform to digital norms, despite the increased societal pressure to do so:

> "We got used to doing things a certain way, and now, at old age, they want to change all that and force you to do what the 30 or 40 year old's are doing. It's difficult. It's not easy. I just say, 'No, I'm not doing that.' I want to do things the way I've always done them."

The accelerated reliance on technology brought on by the pandemic made some participants feel anxious about the future. For instance, P12 stated, "With everything advancing so fast nowadays, I'm afraid that my life will be even more disorderly once it [the pandemic] is over". In particular, several participants worried that in-person offerings would soon become obsolete and that they would be even more separated from the digital world: "I know that in some ways it's inevitable. Everything and everyone is going online. We [non-users] are on our own" (P16).

4.4.3 Some older adults were able to adapt to the pandemic without adopting technology. All four participants mentioned in the previous section (P7, P12, P16, P18) were able to adapt to the "new normal" of the pandemic without adopting digital technology or engaging in online activities. For example, P16 stayed in touch with his family through daily phone calls and P12 fulfilled her social needs by talking with her neighbour over the fence. Other participants, including P7 and P18, engaged in new hobbies, such as gardening and music, to stay busy and pass the time.

Beyond social interaction, participants spoke about other aspects of their life, such as banking and managing telephone bills, that had also transitioned to virtual-only offerings during the pandemic. P18 adapted to these new circumstances by enlisting assistance from a tech-savvy spouse. His wife

helped him set-up his weekly telemedicine appointments and handled all email correspondences (including scheduling the interview for this study). Another participant, P16, who did not have access to a technology "proxy", compromised with his telephone company so that he could receive paper statements (the company had transitioned to paperless during the pandemic) in exchange for a small fee:

> "And it bothers me. But not much I can do about it, so I say, 'Oh, the hell with it.' [...] I don't want it [online statements]. I don't want to live like that."

5 DISCUSSION

In this section we reflect on our key findings in the context of past CSCW, HCI, gerontology, and COVID-19 studies. We discuss the main implications of our research in promoting digital access for older adults and provide suggestions to help narrow the grey divide during the pandemic.

5.1 Ageism and digital exclusion

Throughout the pandemic, we have seen several studies, as well as considerable media coverage about ageism— where older adults are homogeneously viewed as frail and helpless against COVID-19 (e.g., [5, 58, 76]). Public discourse surrounding the pandemic has also shed light on the devaluing of older adults' lives— for instance, an analysis of Twitter data related to older adults and COVID-19 uncovered numerous posts that contained "death jokes" targeted towards older adults, as well as tweets that implied that the life of older adults are less valuable than the lives of younger people (e.g., "we shouldn't trade millions of lives to try saving the very old and frail from a virus") [87]. In section 4.3.1 we described participants' first- and second-hand experiences with ageism, including narratives of digital discrimination and exclusion among their older adult peers and within their communities. In the most extreme cases, older people were purposefully excluded (i.e., not invited in the first place) from virtual activities on the premise that they were "slow" and "too old" to participate. Given the potential consequences of digital exclusion, particularly in the context of the pandemic (e.g., as outlined in section 4.4.2), our findings underscore the need for collective action against ageism. The insights from 4.3.1 resonate with a growing body of CSCW and HCI research which has critically examined ageism through the lens of older adults' lived experiences (e.g., from the perspective of older adult bloggers [48]) and foregrounded it as an important social issue for the HCI community [22, 82].

The underlying reasons for the prevalence of age-based digital exclusion during the pandemic are unclear. However, we speculate that the high-anxiety and stress resulting from the pandemic, coupled with the rapidity with which commercial organizations and social networks transitioned to online and virtual meetings may have been significant contributors. For example, studies on caregivers indicate that high stress and overwhelming demands may be an important factor in ageist behaviours and even elder abuse (e.g., [40, 77]). Additionally, organizers who were compelled to rapidly move activities online may have had to exchange convenience for equity by making the decision to exclude older individuals whose continued involvement could have delayed the transition to a virtual platform. This would be an example of what Thomas calls "ability-based exclusivity", which often occurs due to external pressures (e.g., pressure from higher-ups to transition everything online as soon as possible), rather than by malicious intent [78].

5.2 Reflecting on the technical support paradox

The technical support paradox detailed in the section 4.3.2 demonstrates the conundrum of technology adoption among digitally naive older adults. For this group, online instructional resources (e.g., video tutorials, remote support through screen share and video chat) are moot as they cannot (or

struggle to) digitally connect in the first place. This paradox closely resembles the digital literacy paradox of older adults [69], which describes how prior engagement with technology is crucial in gaining digital literacy but without digital literacy it is impossible to engage with technology in the first place.

Leung et al., made an observation related to the technology support paradox in the context of learning to use mobile devices: older adults, especially beginners or novice users, preferred demonstration over online resources because they found that the online instructions were overwhelming and daunting to navigate [50]. Similarly, a recent CSCW study on the adoption of video streaming for online education during the pandemic found that in-person family support was one of the most effective ways to troubleshoot technical challenges in senior teachers who had low digital literacy and no experience in online teaching [14]. Together, these findings indicate that technology innovators should consider offline support to cater to novice older adult users and highlight the need to re-examine how effective support can be delivered under the unique circumstances of the pandemic.

5.3 Pandemic "phases" and how they impact technology practices

The COVID-19 pandemic is evolving rapidly, and in response to these changes, local governments in North America are taking a phased approach to contain community-spread of the virus. Most jurisdictions, including British Columbia, implemented a partial or complete lockdown and gradually eased the lockdown restrictions once hospitalization and mortality rates stabilized or declined. In mid-May, which was when we conducted our first round of interviews, the government announced that they would allow businesses and public spaces to reopen with physical distancing requirements in place. COVID-19 restrictions were further relaxed throughout the course of the study. By late-August, which was when we conducted our last interview, most businesses were open, many people were engaging in small indoor and outdoor personal gatherings, and the widespread anxiety regarding the virus had decreased substantially in response to the development and distribution of COVID-19 vaccines.

How do these contextual circumstances impact our data? Most notably, some participants who were interviewed during July and August, reported that they were attending social gatherings and slowly expanding their pandemic bubble. As a result, the urgency and enthusiasm to adopt technology (as outlined in section 4.2.2) was less prominent in these individuals compared to those who were interviewed in the earlier months of the study. This observation reinforces findings from past studies that have demonstrated that older adults are particularly motivated to learn technology when they perceive it as fulfilling a need [8, 16, 34]; but when that need no longer exists, they may limit usage or abandon it altogether [30, 79]. Further research into future technology practices and technology adoption patterns is warranted, as the pandemic is ongoing (albeit, seemingly coming to an end), an increasing number of organizations are going "fully digital", and restrictions on social gatherings are constantly changing.

5.4 The adaptability of older adults and the future for non-users

Our findings collectively demonstrate the resilience and adaptability of older adults when faced with unexpected life circumstances such as the pandemic. As detailed in 4.4.1, many older adults adapted to the pandemic by adopting new technology, improving their digital skills, and by participating in online activities. Similarly, the findings from 4.4.3 showed that even non-users were able to acclimate to a certain extent—for instance, by enlisting assistance from a tech-savvy spouse to access services that had transitioned from offline to online. These findings are consistent with prior research that has highlighted the abilities of older adults to adapt and surmount adverse life events (e.g., [11, 35]). This includes a recent study which examined various coping strategies of

older adults during the initial weeks of the pandemic and found that the majority of older adults perceived themselves to be coping well [27]. Our findings contribute to advancing HCI literature on older adults which aims to dispel pre-existing stereotypes (e.g., that they are technologically inept and vulnerable) and, rather, demonstrate their competence and strengths (e.g., [21, 49]).

As highlighted by Knowles and Hanson, several decades of HCI research has focused on enabling older adults to adopt technology [46]. However, our findings from 4.4.3, indicate that the older population is a diverse group with some highly motivated and others who are resistant to technology adoption. During the pandemic, some in the latter group had to significantly alter their lifestyle or "pay a price" in order to cope without technology (e.g., pay a fee in exchange for paper statements, miss out on social interaction opportunities). What does this mean for CSCW and the broader HCI community? We believe that there is a pressing need to provide alternate mechanisms for non-users to navigate an increasingly "online-only" society without being disadvantaged. For instance, new technological innovations should consider the older non-users by offering non-digital solutions. This is particularly important given the context of the pandemic, which has rapidly accelerated the trend towards online ways of life.

5.5 Suggestions to increase digital access and bridge the grey divide

Here, we propose four solutions grounded in our findings and previous work to increase digital access for older adults. Although these solutions were devised to be specific to the COVID-19 pandemic and feasible under current pandemic circumstances, they may also be applied to similar crises in the future and to non-crisis situations as well—especially given the significant societal and cultural changes (e.g., the increase in digital-only services and remote workers) that will likely linger long after the pandemic is over.

5.5.1 Increase opportunities for in-person technology support. As outlined in section 4.3.2, many participants desired in-person support when learning new technology. This finding resonates with research reporting on the great potential of collaborative learning [38] and with survey results that suggest older adults often need others to show them how to use new devices [3]. Although there are some studies that suggest that older adults prefer independent approaches when learning technology (e.g., [59, 71]), these approaches may not be suitable under pandemic conditions. For instance, learning by trial-and-error can be fraught with many errors and also time-consuming [80]. However, during the pandemic, it is crucial for technology adoption to occur quickly and efficiently because it may be the only mechanism for enabling social interaction and being connected to the outside world.

Although the pandemic has created a number of new barriers to accessing in-person support, such as lockdown measures and pandemic bubble restrictions, communities could help facilitate tutorial sessions between technology support workers and older adults with increased safety precautions—similar to how home care services are being delivered during the pandemic. Alternatively, electronics retailers and other venues offering tech-support could set aside hours where only older adults are welcome into the store.

5.5.2 Mandate anti-ageism interventions for activity hosts and institutions. Activity organizers and hosts can play a crucial role in helping older adults familiarize themselves with new technology. However, as detailed in section 4.3.1, in some cases, these were the very individuals who displayed ageist behaviours and attitudes. We believe that negative age stereotyping and other age discrimination are occurring on a large scale during the pandemic. In addition to the negative effects of ageism on older adults, such as unintentional endorsement of negative stereotypes [51], age-based discrimination of older adults in the digital space may exacerbate their feelings of social isolation—particularly if technology is the only window for social interaction.

Researchers in gerontology have suggested reducing ageism through education and awareness campaigns about aging that dispel negative and inaccurate views of older adulthood [52, 54, 57]. We believe that institutions and communities serving older adults should follow these suggestions and mandate anti-ageism interventions for their staff to enhance empathy and reduce age discrimination.

5.5.3 Leverage older adult tech-enthusiasts. As presented in section 4.3.3, there are older adults who are unable to adopt technology during the pandemic because they are apprehensive to reach out to their own family members and younger adult friends for help. This finding aligns with prior research that has demonstrated older adults' concerns about being a burden [13, 33] and their reluctance to adopt new technology because they do not want to bother others for assistance [88]. The fear of burdening younger people is likely even more pronounced now due to the pandemic's devastating impact on the economy and job market, which have left many younger adults stressed, jobless, and facing insolvency. To address this problem, we suggest leveraging tech-savvy older adults as alternate sources for technology support.

Now, with the flux in older users who have gained new technical expertise and confidence, there are even more of these individuals who could potentially support new and novice users. In fact, a number of studies have demonstrated that older adults are highly effective technology "proxies" because they can "speak the language" of older adults [16] and enhance the perceived ease of learning a technology (e.g., by demonstrating that a person of similar age and ability can use that technology) [44].

5.5.4 Create a fast and simple onboarding experience. Finally, a key area for improving technology adoption in older adults is to improve the technology itself. Despite the abundance of past research which has highlighted differences in technology-related preferences, needs, and concerns between older adults and younger populations (e.g., [26, 29, 62]), the senior user base is often overlooked during technology design. For example, modern interfaces are frequently designed with the assumption that users will intuitively understand interface elements, such as navigation, icons, and other important functions—however, older adults with a lack of digital experience may stumble without additional guidance. Indeed, the complexity of the setup and onboarding process associated with adopting new technology (e.g., downloading new software, creating an account, navigating the interface for the first time) was a major barrier to technology adoption for several participants described in 4.4.2. Technology innovators can mitigate this challenge by simplifying the onboarding experience—for instance, by reducing the number of steps required for installation and configuration. Now, with the rapidly increasing number of older technology users, it is more important than ever before for designers to consider the needs of senior technology users, including those who have little to no prior experience with technology, throughout the design process.

6 LIMITATIONS

Our work provides detailed insights into the impact of the COVID-19 pandemic on digital social interaction and technology adoption among older adults. The findings presented in this study could be augmented by including groups with more diverse socio-demographic backgrounds. Notably, the older adult sample that we recruited is exceptional in that the majority are well-educated (18 have a university degree or higher) and all own or have access to a computer or phone. Indeed, because our study was conducted remotely, the ability to use a digital device for communication was a prerequisite for participation. None of the participants reported any significant health impairments or socioeconomic-related limitations that hindered their capacity to access a computer or phone. Of the 24 people interviewed, only three participants did not know how to use instant messaging apps, social media, and/or videoconferencing platforms. This should not be viewed as representative.

The challenges of digital exclusion are likely to be even more pronounced among a larger, more diverse group of older adults.

Our findings focused exclusively on older adults ages 65+. Although there may be some parallels between the experiences of this age group and younger generations, such as challenges with adjusting to new videoconferencing platforms, the technology adoption barriers identified in this study are likely to be more pronounced in the older population. For instance, ageism is unlikely to be a significant factor for digital exclusion in the younger population. Future work could examine the experiences of younger age groups and compare them with the findings from this study.

7 CONCLUSION

In this study, we found several important findings among older adults who have and have not successfully leveraged communication technology to cope with the COVID-19 pandemic. Notably, we found that lockdown restrictions and physical distancing orders created a strong social incentive for older adults' technology adoption. Although the majority of older adults in this study were able to adopt new technology and remain socially connected, there were a number of barriers that hindered others. One important and common impediment was poor and in some cases, no access to in-person technology support due to pandemic bubble restrictions and heightened apprehensions to seek help from younger family members and friends. Older individuals also reported challenges with ageism, which sometimes led to their exclusion from online activities.

Collectively, the aforementioned factors have contributed to considerable changes in the "grey digital divide". Many older adults have crossed the divide and have successfully adopted new technologies into their daily lives, which have enabled them to maintain their social activities and networks throughout the pandemic. There are others, however, who remain disconnected from the digital world. Our study highlights the pressing need for effective interventions to enable these individuals to surmount technology adoption barriers for those who wish to do so, or find non-digital solutions for those who wish to remain offline.

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