

Investigating Older Adults' Adoption and Usage of Online Conferencing Tools During COVID-19

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ABSTRACT

The COVID-19 pandemic has led to major adjustments for individuals. Tasks which were once conducted in-person, are now being performed online. While this may result in efficiencies for those with strong technical know-how, challenges can be faced by different groups of users, including older adults, particularly those with limited or no experience with online conferencing tools. This can lead to difficulties performing tasks which others take for granted (e.g., communicating with others and attending medical appointments remotely). Concerns still remain regarding the usability of these tools, and the security and privacy of data when performing tasks. We conducted a set of interviews to understand older adults' (aged 60 and above) experiences transitioning to online conferencing tools during the pandemic, and identify their perspectives for future usage of these tools. We found that the process of adapting to these tools varied among participants. Older adults interviewed described coming together to form a community of practice to troubleshoot usability issues. They also described valuing trust within a solution highly when adopting newer technologies. Finally, effective communication and social interaction through these tools was found to be prioritized over higher-level privacy concerns, especially during the earlier stages of adoption. Implications arising from findings can inform the designers of online communication solutions who may overlook the needs of this community who now rely on these tools to support daily living tasks.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

Older adults, Online security and privacy, Technology adoption, Online conferencing tools, COVID-19

ACM Reference Format:

Hirak Ray, Ravi Kuber, and Adam J. Aviv. 2022. Investigating Older Adults' Adoption and Usage of Online Conferencing Tools During COVID-19. In *19th Web for All Conference (W4A'22)*, April 25–26, 2022, Lyon, France. ACM, New York, NY, USA, 11 pages. <https://doi.org/10.1145/3493612.3520447>

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W4A'22, April 25–26, 2022, Lyon, France

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ACM ISBN 978-1-4503-9170-2/22/04...\$15.00

<https://doi.org/10.1145/3493612.3520447>

1 INTRODUCTION

Lockdown restrictions associated with the COVID-19 pandemic have changed the way in which daily activities are conducted. Interactions once conducted in-person, are being performed online [4, 12, 17, 33]. This has resulted in increased levels of adoption of online conferencing tools (such as Zoom, WebEx and Skype) to enable individuals to continue regular communication, and educational and work-based activities while adhering to social distancing requirements and safety measures [4, 12]. The unprecedented situation has impacted individuals in different ways. While those with strong backgrounds or prior experience with technology may have experienced a smooth transition to daily online communication during the pandemic, some groups of users have been disproportionately affected. Examples include older adults [37], who have been known to shy away from using technology or resist adoption altogether due to usability, security and privacy concerns [29]. Many have ultimately ended up with little choice other than to learn how to use and adapt to online conferencing tools to keep up with current circumstances.

Online conferencing tools are particularly beneficial to older adults, providing an alternative means for them to stay connected from home, and allowing them to participate in more interactions which they would not otherwise have been able to conduct due to physical limitations and the geographical restrictions imposed by lockdown [19, 27]. However, challenges can be faced if users are unfamiliar or less confident using technology, and/or if vulnerable to other threats. For example, older adults are known to be less informed of both possible online privacy violations and the protective measures they can take against those attacks [8]. In an attempt to familiarize themselves with new technology and learn how to resolve usability challenges which emerge, older adults may practice poor levels of security hygiene, leaving them exposed during initial stages of transition.

Studying the process of how older adults have adapted to the 'new normal' offers the ability to understand how usability impacts communication and collaboration when using or adopting these technologies. Findings could offer promise to designers and researchers aiming to improve interactions with online communication technologies for a wider demographic of users. The needs of older adults are known to often be overlooked in the design of products and systems [35]. The aim would be to identify implications which can be used to develop stronger, more targeted usability, security and privacy-related guidance.

In this paper, we describe a qualitative inquiry where older adults' (aged 60 and above) concerns and experiences transitioning towards online communication were examined, in light of lockdown requirements. We specifically focused on examining the usability of these

tools, taking into account issues of privacy and security. To account for differences in technological experience within the older adult community, we classified our participants as younger-older adults (ages 60-74) or older-older adults (ages 75+), similar to the classification used by Fisk et al. [7]. This can provide insights into how technology providers (e.g., Cisco WebEx and collaboration tools) can better cater towards a large heterogeneous community of older adults whose needs are overlooked in the product design space.

This research has resulted in the following contributions:

- An investigation of the transition to online communication for older adults during the COVID-19 pandemic. We present their motivations and concerns in the initial stages of adoption, along with how they have adapted over time;
- An analysis of their usability and privacy concerns with online conferencing tools, looking into specific privacy features such as virtual backgrounds, waiting rooms and filters;
- Discussion of the trade-offs made by older adults between usability and privacy of online conferencing tools during adoption, and suggestions for new techniques for increasing trust and awareness of these tools.

This study may offer considerable potential to better understand how usability and privacy concerns affect older adults' adoption of new tools. We suggest focusing on the role of advocacy and education to improve trust between older adults and online conferencing tools, allowing for a smoother transition to online communication, as well as alleviating concerns of adopting newer technology.

2 RELATED WORK

Challenges Faced by Older Adults With Online Communication. Prior studies have investigated older adults' usage of technology and the internet as a communication tool. Examples include a study by Gatto et al. [13]. The researchers examined the perceived benefits and barriers encountered by older adults when using computers. Challenges faced included frustration, physical and cognitive limitations, as well as issues with trust. Difficulties with setting-up tools, along with the general usability of these technologies, were identified by Genoe et al. [14]. The researchers' findings highlighted that complex terminologies made it difficult for older adults to ask for assistance. While family members were willing to help their older relatives, the lack of understanding of certain concepts among some older adults, made it challenging to guide them effectively. Specific frustrations with online communication were also highlighted by Sum et al. [36]. The researchers found that greater use of the internet as a communication tool resulted in lower levels of loneliness among older adults and a higher positive effect on a sense of belonging to an online community.

Challenges which were experienced by senior residents in long-term care (LTC) facilities when using online conferencing tools through personal devices (e.g., iPads), were identified in a study by Moyle et al. [24]. The difficulties were found to be more prominent in cases where older adults did not receive external assistance from others. Older adults, however, did consider online conferencing as an effective way of communicating with family and friends, despite expressing concerns over privacy and cyber-security issues. This shows evidence of a trade-off made by this demographic when it comes to the security of online conferencing tools, depending on

the context of their task. Researchers have also investigated how visibility and transparency of various features and settings affect users' privacy decisions. Marks et al. [22] identified the importance of making privacy settings easily accessible and understandable to all users on online conferencing tools, which showed a positive response from users who were able to password-protect their meeting URLs. The privacy risks associated with online calls and meetings were also explored by Kagan et al. [20]. The researchers identified that the privacy of social accounts can be compromised by cross-referencing participants in multiple conference meetings. Recommendations and protection measures were described, including using generic usernames and backgrounds, wearing small masks, and using a filter. This shows the vulnerability of private information in online meetings, and the threats posed to individuals through them.

Older Adults' Resistance Towards New Technology and Adoption due to COVID-19. Older adults are known to take fewer protective actions when using technologies compared to their younger counterparts [28]. As a result of the proliferation of online safety threats, many older adults adopt strategies such as reducing their use of technologies [11, 18], or begin resisting technology altogether [2]. Safety concerns, especially concerns related to online security and data, contribute to older adults' negative perceptions of digital technologies [23]. Privacy concerns and challenges in managing privacy settings are the key perceptual barriers to the adoption of social media [40] and the usage of communication technologies, such as email [32]. This reinforces some older adults' resistance towards technology and the nature of adoption of new technologies such as online conferencing tools when faced by the COVID-19 pandemic.

Research has been conducted on the nature of adoption during the pandemic in various contexts, including pedagogical settings, medical appointments and social meetings. A study conducted by Newlands et al. [25] highlights the increased importance of data protection during this transition to online communication and educating oneself on measures that can be taken to protect private information. Billingsley et al. [3] found that lack of reliability, confidentiality and privacy are potential issues with the use of online conferencing tools. Specifically for older adults, special attention from policy makers and tech companies is required during this pandemic [39]. The importance of not neglecting this demographic is further stressed by Seifert et al. [35], who discuss how the previous lack of digital inclusion of older adults has affected them during the pandemic, specifically those in long-term care facilities.

While this raises concern for older adults with limited experience of technology, who may have had to adopt new tools due to the pandemic, studies have also offered potential avenues to assist them. Friends and family have been identified as advocates who can help groups such as older adults to promote security behavior [31], providing support when needed for tasks such as installation of tools and selecting security features for use. Researchers have yet to deeply focus on the transition to online tools by older adults, including but not limited to the experiences of those with limited technology experience who feel that they were effectively forced into using these tools. Work examining their experiences offers considerable potential when developing online communication tools to match the needs of a wider demographic of users.

Part. No.	Age Group	Age	Gender	Exp. with tech. (1-5)	Exp. with OCT (1-5)	Online Conferencing Tools (OCTs) used	Nature of Adoption
P1	Older-older Adults	81	Female	3	5	Zoom, Skype	Forced Adoption
P2	Older-older Adults	82	Female	4	4	Zoom, Microsoft Meeting	Forced Adoption
P3	Older-older Adults	85	Female	4	4	Zoom	Forced Adoption
P4	Younger-older Adults	72	Female	3	3	Zoom, Skype, FaceTime	Prior User
P5	Older-older Adults	83	Female	1	2	Zoom	Forced Adoption
P6	Younger-older Adults	76	Male	4	5	Zoom	Forced Adoption
P7	Older-older Adults	89	Male	4	4	Zoom, FaceTime	Prior User
P8	Older-older Adults	88	Female	3	3	Zoom, FaceTime	Forced Adoption
P9	Older-older Adults	79	Female	4	4	Zoom, FaceTime	Prior User
P10	Younger-older Adults	60	Male	5	3	Zoom, Microsoft Teams, WhatsApp Video, Skype	Prior User
P11	Younger-older Adults	60	Male	4	4	Zoom, Microsoft Teams, WhatsApp Video	Prior User
P12	Younger-older Adults	68	Male	4	3	Zoom, Microsoft Teams, WebEx, Skype	Prior User
P13	Younger-older Adults	66	Male	5	5	Zoom, Microsoft Teams, WhatsApp Video	Prior User
P14	Younger-older Adults	63	Male	3	4	Zoom, Google Meet, WebEx	Prior User
P15	Younger-older Adults	69	Male	5	5	Zoom, Microsoft Teams, WebEx, Slack, WhatsApp Video, FaceTime	Prior User
P16	Younger-older Adults	67	Female	3	5	Zoom, WebEx, FaceTime, Google Meet	Forced Adoption
P17	Older-older Adults	75	Female	4	4	Zoom, WebEx, Skype	Prior User
P18	Younger-older Adults	73	Male	5	3	Zoom, WebEx, Skype, FaceTime	Forced Adoption
P19	Older-older Adults	80	Female	4	4	Zoom, Skype	Forced Adoption
P20	Younger-older Adults	71	Female	4	3	Zoom, Skype, WebEx, Facebook Video Chat	Forced Adoption
P21	Younger-older Adults	62	Male	5	5	Zoom, WebEx	Prior User
P22	Younger-older Adults	73	Female	2	4	Zoom, FaceTime	Prior User
P23	Older-older Adults	83	Female	2	4	Zoom, FaceTime, Skype, Marco Polo	Forced Adoption
P24	Younger-older Adults	63	Male	5	3	WebEx	Prior User
P25	Younger-older Adults	60	Male	3	3	Zoom, Microsoft Teams	Forced Adoption

Table 1: Demographic information

3 METHODOLOGY

Our study aimed to investigate the concerns and experiences of older adults transitioning towards online communication during the pandemic. We aimed to identify preferences, frustrations, educational resources used to support interactions, along with perspectives on future use of online communication tools.

Approach. We recruited twenty-five participants aged 60 and over through our partners at an independent/assisted living community, a local state-funded senior center, and snowballed through the researchers' and participants' personal networks. The aim of multiple recruitment venues was to gain a wide sample of older adults from different backgrounds and socio-economic groups, all of whom may have differing experiences due to lockdown measures. The interviews were conducted a year after social distancing requirements were mandated in the United States. As a result, participants would be able to reflect on their experiences during this time. Interviews were conducted remotely due to the restrictions attributed to lockdown from COVID-19. Each interview was either scheduled over the telephone or using online conferencing software that participants were most familiar with. Interviews lasted for around 45 minutes, and participants received \$10 USD compensation for their efforts.

Participants. As shown in Table 1, a total of twenty five participants were recruited, who were aged between 60 and 89. We specifically sampled older adults with varying ages, due to evidence of a digital divide within the older adult community [10]. More specifically, fifteen 'younger-older adults' (aged 60-74 - mean age 66.8) and 10 'older-older adults' (aged 75+ - mean age 82.5) participated in the study. We were interested in observing how age and technical knowledge plays into the experiences of using online communication over the pandemic period. By dividing participants into subgroups relating to age, findings revealed differences in terms of usability concerns and attitudes to privacy. These are described in detail in this paper.

Analysis Methods. Semi-structured interviews were selected as they allow flexible, open-ended inquiry. A 27 question instrument

was generated, initially based upon topics derived from previously conducted studies [3, 25, 35, 39]. The instrument was also refined several times as interviews were conducted to focus on the emergent themes offered by participants, clarify language, and to group questions by topic for effectiveness. A few repetitive questions were removed to allow participants more time to elaborate further on their experiences. The question topics included how their methods of communication changed when the pandemic hit, their motivation criteria for adopting specific online conferencing tools, their thoughts on the usability of certain features available on these tools (e.g., virtual backgrounds, waiting room feature, etc.) and the measures taken to protect themselves from online threats. We also inquired about the resources used to troubleshoot issues and alleviate concerns, reflections on their journey of educating themselves on online conferencing tools over the pandemic, and the future use of these tools.

The interviews were transcribed using automated software, and then checked by a researcher. Transcripts were then analyzed with open coding conducted by one rater. Analysis involved thematic coding, producing a codebook with themes such as "don't trust new doctors on virtual appointments". A second coder performed an inter-rater reliability procedure on 25% of the transcripts. Reliable results were indicated by this procedure (overall Cohen's $\kappa = 0.79$). 167 codes were extracted in total across 36 categories.

4 LIMITATIONS

Although commensurate with sample sizes in other studies, it has been acknowledged that the number of participants recruited in our study was lower, making it difficult to make generalizations. Smaller samples are unfortunately common when dealing with harder-to-reach populations, such as older adults and those with disabilities [34]. It was particularly challenging to recruit during the lockdown period. Venues such as the Senior Center had ceased in-person operations, which limited the range of clients viewing recruitment flyers. Encouraging participants to identify other potential leads offered a method of recruiting for those who may not have been able to access an email-based flyer.

Participants were given the option of being interviewed by telephone rather than video calling. However, many preferred to utilize the video calling capabilities of online conference tools because they sought more awareness who was interviewing them. Of course, conducting the interview using a platform that this is the topic of the interview may impact participants' opinions, both positively and negatively. We acknowledge this limitation in our study, but it was our aim that participants should use their preferred mechanism of communication. Many used video calling/conferencing throughout the lockdown, and thus felt most comfortable using them also for the interviews.

5 FINDINGS

We present our findings in three subsections: (i) the initial transition to online communication which covers familiarization with the tool and adoption motivators; (ii) their usage of the tools during the period of lockdown, covering privacy perceptions and reactions; and (iii) reflecting on the experience with online communication tools and what the future of online communication entails for them¹.

5.1 Transition to Online Communication

Online Tools Used After Lockdown. Participants described utilizing a wide array of online conferencing tools. Zoom was the most frequently used (n=24), adopted by most of the older adults interviewed after the onset of the pandemic. Other tools such as WebEx, Skype, FaceTime, Google Meet and Microsoft Teams were also accessed, depending on the context. Some younger-older adults (n=5) mentioned that they switch between the tools they use, preferring FaceTime and WhatsApp when conversing with family, and Zoom and WebEx when participating in group calls involving some form of structured communication and discussion, such as online classes, group activities and professional meetings. A few more detailed nuances regarding tool usage are also described in further detail in the following subsections.

Types of Calls. Most of the participants interviewed (n=24) used these tools to communicate with family and close friends, especially during the first three months of the pandemic. Reasons for communication were multifold - to check in on welfare, to communicate ways to stay protected, and to exchange tips on how to conduct tasks due to the lack of face-to-face interactions with organizations.

After gaining experience using these tools, some participants (n=10) described levels of confidence growing, inspiring them to use these tools to participate remotely in club meetings, gatherings, conferences and classes. Some younger-older adults (n=8) primarily used these tools for purposes of work, either for conference calls with colleagues, or calls with their clients, whereas some older-older adult participants (n=3) described themselves as "old-fashioned", and preferred making telephone calls rather than video-chatting, especially with other family members or friends who may be less tech-savvy than they are. P23 stated,

"The other people [apart from work] are maybe family members, who are not tech savvy enough. I just haven't found a

big use to get on video. I guess I am old-fashioned. I prefer telephone [calls] for my family."

A few participants (n=4) described important events, now hosted online, which they did not want to miss. These included remote attendance at weddings and funerals, and regularly scheduled events which had pivoted to an online platform (e.g., prayer services).

When asked whether this differed from in-person experiences prior to the pandemic, P15 said,

"The advantages [of online sessions] dominate the disadvantages. When you meet personally, you feel close to somebody and warmth. But the time spent was too much and people are busy. They also have other priorities. When a group of 10 people are there, all 10 need to clear their schedules. But now they can sit in the office and just attend. I can attend 5 sessions a week now, but earlier only 2 per week. And I can attend it from anywhere."

Most of the participants either initiated or were recipients of video calls during the period of lockdown, with a desire to replicate the social environment that they had participated in prior to the pandemic. However, depending on the context, there were instances where participants (n=5) preferred to either converse by phone, or through conferencing tools without showing their camera feed. They felt that events such as prayer services, or online classes with large audiences, only required the "leader" of these calls to show their video, while the audience solely listened. This was preferred by some, stating that this prevented calls from becoming disruptive and allowed it to flow smoothly. These regular meetings were acknowledged by our participants to be awkward and "clunky" at first, where some attendees in the calls would help others learn how to mute/unmute themselves, and check whether their cameras were on or off. It appeared that people were more accepting of these challenges towards this time. This also showed mutual collaboration and cooperation among users in the initial stages of adoption, as users would often signal to others to change settings (or call them privately to walk them through the steps of how to do so). This phenomenon was observed in higher frequency among older-older adults (n=8) compared to younger-older adults (n=3).

Motivation to Use Tools. Most older adults interviewed (n=18) did not have a specific reason or motivation to adopt the tools they used. They often shrugged and said that "everyone was using it" so it made sense to use the most popular tool. Zoom was the subject of these conversations in most cases, since older adult participants felt that others would be able to assist them easily, as Zoom was being used widely among their circles of friends. Tools in use by their peer group were found to be convenient for individuals with limited experience of technologies to adopt, similar to findings from [15].

A few participants (n=5) mentioned that the software was installed on the PC or mobile device they were using for this purpose. This largely correlated to younger-older adults who were yet to retire, and their employers used specific tools on their systems. Participant P23 said,

"WebEx was suggested when I got this laptop by my work and I got assistance with it."

A couple of older-older adults mentioned the need to visit a store and purchase a webcam for their computers. One said that their

¹For our qualitative findings, we use the terms "a few" as 0% to 25%, "some" as 25% to 45%, "about half" as 45% to 55%, "most" as 55% to 75%, "almost all" as 75% to 99%, and "all" as 100% as per Emami-Naeini et al. [6]

computer did not have one to begin with, whereas the other felt like a separate webcam would offer better quality, but was unable to elaborate on what “better quality” exactly meant for this situation.

Learning How to Use Tools. Some older-older adults interviewed, who lived in assisted or independent living centers (n=5), highlighted their dependency on the local “computing” expert to resolve issues that came up during the initial stages of adoption. These experts were typically volunteers who lived within the communities, and had some level of computing experience. Since these participants belonged to tight-knit communities, they felt comfortable asking for help, and preferred relying on others rather than a process of trial and error to troubleshoot their issues. A few participants expressed a mutual form of assistance, where those who were in the call helped each other through usability issues involving their camera, microphone and audio/visual concerns. Participant P4 said,

“If I was on the phone, then I would ask somebody how to fix it. If it is a persistent problem, I ask the IT connections expert in the living community.”

A few older-older adult participants (n=4) knew that they could search for ways to support online communication, if challenges were faced. However, they found it difficult, and did not know how to phrase search terms correctly to identify solutions for their queries.

“Because I don’t like reading manuals and I don’t think I know the correct questions to ask to find it”

Some younger-older adult participants (n=4) described training sessions conducted by their employers to prepare their staff for remote communication at work when the pandemic started.

“That was important to have. Such an interactive training [session] with someone who knew what they were talking about so we could ask questions. Questions like “How do I grab the screen?”

Usability Concerns and “Zoom Fatigue”. Most of the older-older adults (n=8) described experiencing issues with the tool’s usability, and were extremely expressive regarding their frustrations. This included issues with Internet speed and weak signals which could be monitored by the icon on their task bar, updates to the software which subsequently would hinder usability, slow and outdated hardware which would slow down the communication process, and “Zoom fatigue”. P5 described the experience of a book club meeting held online,

“I found that I wouldn’t last an hour. When you have six people talking, there is a lot of repetition and I lost interest.”

Participants also expressed how their usability concerns affected their perceptions of the tool, and future interactions with it.

“Problems with the website’s usability carried over to discomfort with the tech itself.”

Socializing from Home vs. Work from Home. Almost all participants (n=24) mentioned differences between informal calls with their friends, and more formal calls with individuals outside of their personal networks, be it work-related or for recreational purposes. This included a general lowering of one’s guard in informal conversations, and lower levels of anxiety regarding displaying their physical surroundings. As an example, there was less concern

for showing their physical background when on camera within their personal networks. Participants also expressed a lower level of privacy concern when having informal conversations, stating that “we don’t talk about sensitive information” or “there is nothing worth worrying about”. Conversations in more formal settings led to increased levels of concern regarding their own appearance or the appearance of the physical background. Participants would ensure they were seated in a well-lit room and in an undisturbed environment, either in an office space or in front of a blank wall. This was coined as “being professional” by some, and “being polite” by others.

Experience Changes Over Time. Most older-older adult participants (n=8) expressed that the quality of the experience had improved since when they began originally interacting with communication tools. Specifically, they described learning better “Zoom etiquette” and good “online manners”, fewer overlaps and interruptions during conversations, and greater awareness of the need to mute their microphone during periods of loud background noise and interruptions. The process of learning how to use these tools effectively over time involved continued usage of these tools after initial adoption, or what the participants called “regular practice”. Participant P24 said,

“I’m more comfortable now getting into meetings. The more times you use it, the more you feel comfortable with doing something. Sometimes it is confusing to know if you are muted or not. Am I unmuting or muting myself if I click this?”

Medical and Financial Appointments. A number of participants described attending at least one virtual medical appointment during the pandemic (n=17). This ranged from visits to discuss serious medical conditions and to discuss arrangements for surgery, to regular check-ups. Some participants mentioned using Zoom for their medical appointments. However, most participants described browser-based applications for their appointments, such as Kaiser Permanente, where software did not need to be downloaded prior to using the app. They could simply do everything through their current browser. Participants touted some benefits of this online transition, believing this to be a viable setup for in-person appointments and being coached by their doctors on what they need to do for their next physical visit. They also expressed that it was easy to present their visual symptoms through these tools, and report their medical status. From a social standpoint, some participants expressed relief on being able to see their regular doctor and a familiar face in their time of need. On being asked about the differences between virtual communication with medical professionals through these tools and regular phone calls with them, P22 said,

“When you’re trying to talk about your body, observation is needed.”

However, there were multiple concerns highlighted as well. A number of participants (n=9) stressed that while they felt comfortable and ‘safe’ sharing their information with their regular medical practitioners, they would not feel the same way with an unfamiliar doctor. Some also felt a bit anxious about using a new medium (i.e., online communication) for this purpose, and needed reassurance from their doctors if this happened. Participant P19 expressed some distrust towards doctors who were unfamiliar, and said,

"If it is not a doctor I am familiar with, I would verify whether they are at least a qualified doctor in that practice by asking questions like their number and name and I will double check."

5.2 Privacy Settings, Preferences, Perceptions and Reactions Using Online Conferencing Tools

General Privacy Concerns. The majority of participants (n=19) highlighted concerns about the privacy and security of these tools. A few younger-older adults (n=4) were a bit unsettled upon hearing of privacy attacks involving these tools, such as "Zoom-bombing", but did not drastically change their interactions or perceptions of these tools as a result. In some ways, there was little choice but to use these tools. The alternative would have been foregoing medical assistance. Some older-older adult participants, on the other hand, expressed vague and unfounded concerns regarding privacy in online communication, stating, "I don't know enough about it to be 100% sure it is private", whereas others described more specific situations where privacy could easily be infringed. Other concerns included detecting and dealing with uninvited attendees in their calls, some of whom may be using aliases. Concerns were also flagged about meetings being recorded without their consent, and attempts to emulate a "safe space" to speak freely. These concerns are described in detail in the following sections.

Physical Background Concerns. Physical backgrounds, the presence of bystanders, and appropriate lighting conditions were recurring concerns highlighted in interviews. Participants described multiple incidents which either happened to them or to others during the period of lockdown. These had impacted their communication habits, leading to modifying behavior when using the tool (i.e., only using it at prescribed times when no-one else would be around to walk in front of the camera etc.).

Older adult participants were largely concerned about bystanders in these calls. They were afraid that their spouse would walk behind them in clothing that could embarrass them, or would say something that the participant would have otherwise wanted to have kept private. They were also concerned about bystanders would overhear conversations. The same concerns applied to phone calls interrupting their sessions. Participants were hesitant to answer calls on their mobile phones, being afraid of others seeing the name of the caller appear on the screen. One participant, P25, also expressed concerns about Voice Activated Personal Assistants (VAs) in the background while they were in an online conference call. They were less afraid of others recording their meeting and bystanders, and more afraid of their Google Home listening into their conversation and recording it in the background.

Surprisingly, minimal levels of concern were shown by some participants regarding objects being displayed in the background when online. A few older-older adults (n=3) said they preferred showing what they have, such as their bookshelves and trophies, allowing others a brief insight into their tastes and personalities. They were interested in seeing the backgrounds of others in the call as well, and curious to know or at least speculate what their lives were like.

Virtual Backgrounds. Very few participants (n=3) utilized virtual backgrounds for privacy during their sessions. Some participants tried it out more out of curiosity than of necessity. They said that "it was fun trying out new things", but did not maintain it as a practice. Participant P23, among many others, did not use this feature, and expressed that he does not have any major concerns about his background,

"Most importantly, I don't care. You get what you see. I don't mind showing people my background."

Digital Backgrounds and Background Applications. Some participants mentioned closing background applications and browser tabs before entering an online conference call. They were concerned about others being able to see their screen without their knowledge, either intentionally or unintentionally. There was a concern that items meant to be private would be disclosed to others. Participant P23 said,

"One reason I don't run WebEx on my personal machine is because I don't want anyone to see the tabs I have there. This laptop I'm on right now is my work laptop, it has my camera and microphone. If I'm about to share, I will close things like my emails."

Most participants did not share this sentiment however. Some thought it impossible for others to gain access to their screen without sharing it themselves, while others did not find it in themselves to add another item to their list of worries. Participant P22 said,

"Privacy concerns are genuine. But I've just about given up. It is different being 83 than being a student. I can see younger people being cautious. I don't want to spend my time thinking about all the bad things that could happen."

Webcam and Microphone Concerns. Similar to the concerns relating to physical backgrounds, worries about being spied upon through the user's own webcam stemmed from incidents which happened to friends or family members. Hearing about these experiences changed the privacy perceptions of some older adults regarding their webcams, and some who admitted to being initially nonchalant about this topic, transitioned into regularly sticking tape over their webcam when it was not in use. Similar concerns were seen with microphones as well, where participants would physically disconnect their microphones from their laptops after calls were terminated. A few younger-older adults (n=4) also made a point of closing the lids of their laptops after their calls ended. This would provide them with the reassurance that their calls had been terminated.

Data Storage Concerns and Recording Meetings. Some participants expressed concerns about meetings being recorded without their permission, and if recorded, where this recording would be located. A few older-older adults (n=4) also voiced concern about cloud storage and uncertainty about how their recorded meetings are stored after the call ends. Below are some excerpts from statements by P14 and P23.

"Where is the server placed? Some cloud services keep the data outside the country. We have concerns, why is the data not stored locally? It is an extension of this concern. But we don't have any other choice."

"They say it is encrypted but I bet the NSA and countries can decrypt the stuff."

The majority of participants admitted that they did not give much thought to being recorded or issues with the cloud, but agreed that it could be something to consider. Those who did express concern also mentioned that protection measures were already in place in the form of state laws.

"I know there is probably a law against it.. I'm careful with what I say on these calls anyways."

Invasions of Privacy. Participants described ways in which they screened attendees prior to joining an online meeting. For example, some (n=4) used the waiting room feature. However, others felt that the additional step "took away from the experience", and wished for the intended attendees to join the call without hassle. Most of the participants admitted that their conversations weren't very interesting and "even if anyone comes in uninvited, they would probably get bored and leave." It appears that the existence of the threat itself and the fact that it happened did not seem to have a drastic effect on their perception of the tool's security. A couple of participants mentioned aliases being a cause for concern, specifically when they were unable to identify those joining a call using their mobile devices, since their phone numbers are displayed instead of their names. They felt that this gave attackers an easy opportunity to pretend to be someone else on a call, and participant P7 felt that they could be "catfished" when engaging in online dating activities using these tools.

Software Updates and Trust. A few participants (n=5), specifically younger-older adults, described a connection to the brand of the software that they were using, and even attributed it to be a motivator for adoption. For example, P20 had used Microsoft products at work, so believed that Microsoft Teams would be the best solution for online communication. Another participant felt that certain software was more trustworthy to use, if it had been used within in corporate settings.

"I feel like WebEx is used more for businesses. For some reason, I have always felt more comfortable."

Some older-older adults did not connect to the software itself, and were open to using any software that their family/friends were using. However, they brought up issues and concerns with software updates. Although they knew that these updates could enable tools to perform at a higher capacity, or even improve security, concerns were brought up that updates may hinder usability and "change too much [on the app]". Some also believed that tools which required subscriptions and memberships were more secure than those which were available for free, and updates were more frequent on those tools as a result. However, they were unaware of the benefits that a paid tool may provide.

"For WebEx, I would assume we are better than un-encrypted but not out of the woods. I don't trust cybersecurity. I don't trust bots. I don't trust the cloud. I don't even trust the password keeper. We use LastPass but I don't trust it. I feel like it is a prime target to hit."

Troubleshooting Concerns and Issues. Most older adults interviewed relied on close contacts for sources of information about usability issues and privacy concerns. In this scenario, the "close" contacts were in quite the literal sense. Older-older adults, especially those who lived in retirement communities, relied on their

neighbors and others in their neighborhood for assistance for using these conferencing tools. These participants would also help each other while in group online calls with each other. Older adults preferred relying on friends within the community first, before relying on experts, even if they lived nearby. On the other hand, a few younger-older adults mentioned attending training provided by their employers or online classes by themselves.

Multiple older-older adults (n=5) found it difficult to troubleshoot their own issues online. They felt that the process itself felt too tedious and that they were sometimes unable to understand the steps suggested by online articles and documentation, often written in complicated jargon. Participant P4 wished for the conferencing tool itself to provide solutions for usability issues which arose,

"If this happens, try this. If that happens, try that. Just a small list. Too much info is overwhelming and I probably wouldn't read it then."

Some participants said that they were careful, and took protective measures to prevent any privacy attacks, which in turn put their minds at ease and minimized their concerns. P23 said,

"We still try not to talk about things like SSNs over WebEx. We try to keep it off personal information, and send it another way if we need to. I would also never say my password."

5.3 Reflections and Moving Forward

Benefits Outweigh the Drawbacks. While the COVID-19 pandemic deeply impacted most of our participants, with some even describing unfortunate events like the passing of close relatives and family, almost all participants (n=23) expressed some positives of learning how to adopt online communication tools during the last two years. Some also highlighted that they were in fact "forced" to adopt tools, but were pleased that they had acquired knowledge of how to do this. Examples of benefits included the reduction of commuting to workplaces and public gatherings, in terms of saving time and money, as well as reducing air pollution caused by vehicles on the road, and fewer risks of exposing themselves and others to COVID. Some older adults described being recommended to use these tools by close friends and family members, and reflected on this time period as an opportunity to rekindle relationships with them. Participant P23 said,

"It is cumulative in its relationship. Especially for family. I'm glad we have it."

Feature Requests. Most participants seemed fairly satisfied with their experiences with online conferencing tools during the pandemic. A few participants compared some tools to others, and wished that a few tools followed the others' example. For instance, P12 hoped that Zoom would allow participants to "preview" their webcam display prior to joining a call, allowing them to check their appearance before showing themselves to others. They preferred WebEx over Zoom primarily due to this difference. A few other participants had more futuristic desires, hoping for these tools to be integrated with holographic projections at some time in the next few years. They felt that the visual feedback from others in the call, such as body language and facial expressions, help public speakers on these virtual platforms. Some participants wished that file sharing through these tools was easier especially during conversations with their medical practitioners, with one participant (P2) saying,

“For instance, I do not know if I wanted to send a photograph via Zoom, I don’t know how to do that. That is certainly something that needs to be made easier, and it’s going to be a major thing for older people because we have lots of medical problems.”

Continuity of Tool Usage After the Pandemic. Almost all participants (n=24) wanted to continue using online conferencing tools after the end of the lockdown period. They claimed that these virtual meetings have become an integral part of their lives, and it would be difficult to go back to how things once were. Efficiencies may also be gained through these meetings, reducing commuting time. Most participants also preferred the convenience of being able to work in “less restrictive” clothing, and not having to worry about traffic and the weather each day. A couple of participants voiced some concerns about continued usage of these tools, claiming to have become too “sedentary”. These participants would prefer if most appointments were in-person after lockdown, with the option to attend them online, albeit sparingly. P2 also voiced concerns about learning newer technology and being forced to adopt it in the future,

“Will we continue to use this kind of technology? Yes. But the pressure of learning how to do it and helping one another learn how to do it? We’ve gone about as far as we’re going to go. Heaven forbid that we have another COVID.”

Future Trajectory of Communication and Work Culture. A few participants (n=6) were optimistic about the implications of using online conferencing tools during lockdown, and what this would mean for how people communicate with each other in the future. They felt that most contexts which require communication could follow a “hybrid” approach, similar to the standard set by some workplaces and most universities. They followed the philosophy of “the more options the better”, allowing those who may be unable to physically attend certain events to now do so. One participant (P8) mentioned,

“Work from home should become a permanent option wherever possible. It was fine during the pandemic, mostly. The world didn’t come crashing down.”

6 DISCUSSION AND IMPLICATIONS

Usability and Security/Privacy Trade-offs. Our interviews with older adults brought some interesting themes to light. We found that older adult participants had varying experiences with their transition to online communication, traversing a journey of learning and adapting to these online conferencing tools. For many, this was a new experience in general, as older adults have been identified by researchers as sometimes being averse to using technology [29]. Therefore, this context which “forced” some older adults to adopt online conferencing tools to continue frequent communication, which is a basic life necessity for most, allowed us deeper insights into the trade-offs they needed to make while doing so. Concerns relating to the usability of communication software, appeared to overshadow worries relating to privacy and security. For those less familiar or unfamiliar with online conferencing tools, help was sought from neighbors and those in their personal networks who were considered more “tech-savvy”, prior to seeking help from recognized experts. It appears that older adults are less likely to turn to experts for troubleshooting **usability issues** if they are not known

or trusted. For **privacy and security related issues**, however, they appeared to rely on younger members of their family, such as their children or sometimes even their grandchildren. Participants seemed to believe that those within their age group would be less likely to know about privacy and security when compared to a younger generation. It could also imply that privacy and security issues could be considered more urgent and important by these participants. As a result, they felt that younger adults (of those they trust) are more experienced in this field, and are a more reliable method of troubleshooting than asking their older adult friends, who may be less certain of their advice. These findings are similar to those of Aviv et al., who identified differing levels of trust with known actors between age groups [1].

Contextual Trust. The value of trust among older adults also seemed to be highly important. We asked older adults about specific contexts and situations which may have arisen during the lockdown period. This included medical appointments, financial appointments, online classes, work from home, and other specific one-time events such as birthdays and anniversaries. Most older adults seemed to be more cautious in contexts involving financial information and personal information. Of course, some of these concerns could be attributed to the change in environment itself, accompanied by a sense of unfamiliarity and discomfort. In these situations, a few participants mentioned a sense of relief seeing the familiar faces of their regular practitioners. However, what if their medical appointments were with a new doctor, someone with whom they were yet to establish a rapport with? Most older adults admitted that they did not feel as safe and as **free to talk** about whatever they wished to when they were with new doctors. A few participants felt the need to interrogate the doctor first about their background and professions, prior to revealing their own personal information. There were also instances where older adults would ask doctors to show their background and surroundings to ensure that they were indeed speaking in private. However, when it came to talking with others, such as friends and social gatherings, there seemed to be a level of complete faith, particularly among forced adoptees. Participants felt that there was nothing to worry about in these conversations, and spoke without reservation. A few participants also seemed to be more willing to join weekly clubs/sessions if they were organized by people or groups that they trusted or at the very least recognized. This implies that the person that the participant is having a conversation with largely impacts their privacy decisions, their level of trust and the way they communicate with others in the call. These findings can be connected to those of Van Tilburg et al. [37], who found older adults’ levels of trust varied depending on the quality of social contacts and societal institutions.

How Personal Biases Affect Privacy Decisions. We observed some key differences between younger-older adult and older-older adult participants, especially on their concerns about sharing their video feed on online calls. Younger-older adults interviewed were more hesitant to show themselves on camera. They were afraid of being judged by others by either showing their surroundings, or just showing their faces. They felt that being judged by others would affect their perceptions of them, and would therefore affect their relationship with them. This was especially prevalent in situations where first impressions were considered important, such as job interviews

and conference meetings. On the other hand, older-older adults preferred displaying their faces on camera, and would sometimes insist that others do the same. While one aspect is privacy-related, and ensuring that there are no bystanders on the other side of the call, most older adults felt that backgrounds offered a talking point in conversations, and allowed them to understand “who they [the other person in the call] really are”. It allowed them to see others’ preferences and tastes, as well as show their own. It appears that older adults feel like they have less concerns about the judgement of others, and would rather everything be visible than hidden. Some personal biases were also observed through cultural differences among our participants. A couple of participants brought forth this point themselves, and mentioned that the importance of privacy and security are more prevalent in western countries than in eastern countries. We see the importance of this difference in personal beliefs and perceptions in Machuletz et al.’s study [21], which investigates the likelihood of users resorting to covering their webcams for privacy.

A few of our participants’ privacy decisions seemed to be based on inaccurate or erroneous mental models. Some older adults believed tools which were available for free were less secure than those which required subscriptions, despite being unaware of the benefits that the paid tool may provide. Instances were observed of technology avoidance, where older adults believe that limited usage of these tools minimized cause for concern about privacy threats, a finding similar to those of Ray et al. [29]. When participants felt the need to be more self-informed about the tools they used, they relied more on trusted individuals first, before turning to those whom they considered “experts”.

The Importance of Normalcy During States of Transition. While asking older adults about their transition to online communication, most participants showed some excitement and enthusiasm in their responses. However, most of their responses initially highlighted the struggles they went through in an attempt to replicate “normal conversation”. Asking older adults about concerns during their experiences with these tools normally resulted in comparisons to in-person conversations, and how close or far these online conferencing tools compare to them. They were less likely to be satisfied with their experiences with these tools if it strayed too much from their familiar sense of socialization, even if it meant an improvement in privacy and security. For example, some participants expressed frustrations about some software updates since it made it difficult to use the tool, even though the update could possibly make the tool more secure. Evidence of this was also seen by Nicholson et al. [26], who found that software updates received negatively by older adults dissuaded them from updating the software in the future. Older adults highly valued social cues and proper etiquette. A participant pointed out that looking away and typing during an online call could be considered impolite, alluding to our actions during the interview being conducted, but added that it was understandable in this case. Such actions among others that people tend to do during online calls seemed to take away from the socializing aspect of online communication, and was something that it lacked when compared to in-person interactions.

6.5 Privacy Behaviors During the Interviews. There were some interesting observations recorded during the interviews conducted

with our older adult sample. Some participants seemed to be indifferent about privacy as the interview started, but became more curious and possibly aware of privacy threats as the interview progressed. A few participants were initially unaware of virtual backgrounds and that blurring filters could be used, as well as other features such as the waiting room enabling users to restrict entry. The conversation motivated them to try these features out in their future appointments, and a couple of participants experimented with these features during the interview itself. This was true for both age subgroups. This implies that while a significant number of older adults do not use every feature at their disposal in their interactions with these tools, they are not averse to learning how to use them if it serves their needs.

Initial Usability Frustrations Overshadow Privacy Concerns. Some older adults identified privacy concerns alongside usability concerns, and consciously made trade-offs between them. This was seen with respect to their overall interaction with the software, as well as the methods incorporated to address issues which arose. However, many older adults described frustrations with the tool’s usability during early transition. These mishaps would become their focus of attention, and a few older adults admitted to never even considering the existence of privacy and security threats on this platform. This could well be explained by the drastic change in their social environment and daily lives due to the pandemic and its social distancing requirements. Awareness of these threats seemed to stem mostly from word-of-mouth and personal experiences, which only seemed to occur a few months after initial adoption. This gives us some insight into the hierarchy of importance when it comes to different aspects of online conferencing tool adoption among older adults.

Conformity Motivates Adoption. Older adults who were interviewed felt in most cases, forced to adopt online conferencing tools due to the social distancing requirements of the COVID-19 pandemic. However, motivations for adopting specific tools over others were largely different from younger samples. Younger adults adopted tools in which calls were easier to schedule [16], to proactively reach out to people they wished to connect to [9], and the tools’ overall usability and the features it supports [5]. On the other hand, older adults tried to adopt the same tool as the person they wished to talk to, especially with close friends and family members. They appeared to trust the tools without much room for doubt, since the tool was already being used by the other party, whom they were familiar with. Older adults were also shown to be more willing to adopt specific tools if advocated by loved ones. This shows the importance of advocacy to improve trust between older adults and online conferencing tools. A few older adults opted not to use these tools when speaking to specific friends or relatives, since they knew that using the tool would be more challenging for those people. It appears that older adults are quite aware of their own technical knowledge, and how it compares to other people in the call with them.

Awareness Reinforces Trust. As observed previously, trust plays an important role in the interaction users have with tools they adopt. Our findings suggest that the level of trust older adults harbor towards these tools can be influenced. One of the most influential

factors was the impact of training at the time of adoption. While the substance taught itself pertained mostly towards usability, the increased awareness which it brought forth as a result allowed users to become more comfortable with using this tool during their earlier stages of adoption. As their trust with the tool increased, their privacy concerns and fears were gradually alleviated, at least to some extent. From this, we can imply that general classes can teach older adults how to develop trust, familiarity and overall awareness, while specific privacy and security classes can be an extension to describe privacy protection measures. Our themes of empowerment through education for older adults' experiences with technology seemed to closely follow those of Ray et al. as well [30, 31].

Unaware of Strong Privacy Protection Measures and Tools. While older adults did mention some privacy protection measures they adopted, such as refraining from mentioning confidential information, there was not much mention of using specific tools to protect themselves while online, such as Virtual Private Networks (VPNs). Conferencing tools such as Zoom maintain comprehensive documentation of how users can protect their data, as well as various authentication methods to protect their accounts. It also describes various privacy features offered by the tool (such as the waiting room), and the policies in place to ensure the tool's safety. However, as we have seen previously, older adults are not keen on turning to online documentation for assistance at times of distress while using these tools, and would rather turn to trusted individuals for assistance. Information retrieval also proved to be difficult for those older adults who did attempt to search for help online. To improve security hygiene for older adults and potentially most users, nudges could be inserted into the tool itself to highlight the potential privacy features the tool offers, as well as how this would help them protect themselves. For example, Zoom's website mentions several features available for users to maintain stronger privacy and security habits in the form of blog posts [41], as well as features that are available in the software. However, considering older adults' aversion towards browsing online for support, providing a visible nudge or link to this website within the software itself may help them find this information easily.

Improving Trust With Online Conferencing Tools through Advocacy and Education Strategies. As discussed previously, education offers solutions to address older adults' erroneous mental models, while teaching them how to develop familiarization with online conferencing tools. Empowerment through education has been encouraged in past work as well. Wang et al. [38] discuss the benefits of providing manuals and instruction handbooks alongside technological devices to tackle older adults' knowledge barriers, expressing caution with the language and terminology to allow novice users to adopt the technology easily. We propose that this measure must also be taken with online conferencing tools which offer guidance to users, especially older adults who may struggle to understand certain terminologies and features on the tool's interface. In our study, we discuss how participating in classes can help older adults develop trust by familiarizing themselves with the tool. Elaborating on this further, older adults could be assigned tasks to perform with these tools. For example, they could be asked to send invitations to others in the classroom while authorizing

those who enter the call, as well as discovering and using certain filters to obscure their environment. This would improve older adults' familiarization with the tool, while simultaneously teach them stronger privacy habits. Previously, we also discussed the role of trusted individuals, such as close friends and family members, and how they affect older adults' interactions with online conferencing tools. In terms of adoption, older adults were more willing to trust and adopt new tools used by those they trusted [38]. Younger family members, such as children or grandchildren, can advocate and teach older family members about the benefits and adoption process for the specific online conferencing tool they are already accustomed to themselves, motivating regular family calls to stay in touch during the pandemic. This could be replicated for other situations which warrant remote communication as well, such as physical disabilities due to old-age, or geographical constraints.

Adoption, Usage and Privacy Perception Differences Within the Older Age Community. Multiple differences were observed between younger-older adults and older-older adults. Initial stages of adoption saw different approaches of tool familiarization between the two age subgroups. Older-older adults developed a form of a 'community of practice' of mutual collaboration, where they would assist each other within online conference calls, whereas younger-older adults sought training of some sort, either through mandatory training sessions at their workplace, or online classes offered within their community.

We also see differences in the way online privacy threats are perceived. Younger-older adults showed awareness of potential privacy invasions from unfamiliar sources and knowledge about Zoom-bombing incidents, whereas older-older adults were more concerned about family members appearing in their backgrounds undressed, or names appearing on their mobile devices if they received another call during an online meeting.

Adoption motivators also seemed to differ between the two age subgroups. Younger-older adults adopted online conferencing tools which could be integrated easily into their work practice and personal projects (for example, companies which primarily used Microsoft products incorporated Microsoft Teams during the pandemic), whereas older-older adults adopted the same tools which were used by the person they wished to talk to, as discussed earlier.

7 CONCLUSION

In this paper, we described a study examining older adults' (aged 60 and above) concerns, experiences and resistance toward adoption and continued usage of technologies as a method to support online communication in light of COVID-19 isolation requirements. Design implications have been described to support older adults when using online conferencing tools, with a view to alleviate concerns about their usability, privacy and security. These can aid designers and researchers developing conferencing tools for a wider audience.

ACKNOWLEDGMENTS

We thank Trudy Downs, Brian Gentile, Hans Keller, and Shyam Ravichandran for their input to this work.

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