5-8-2020

Digital Communication Tools Used by Those 65 and Older: The Benefits and Barriers of Use

Susan Quatro
sxqvcs@rit.edu

Rochester Institute of Technology

School of Communication

College of Liberal Arts

Digital Communication Tools Used by Those 65 and Older: The Benefits and Barriers of Use

by

Susan Quatro

A *Thesis* presented

in partial fulfillment of the Master of Science degree

in Communication & Media Technologies

Degree Awarded:

May 8, 2020

The members of the committee approve the thesis of

Susan Quatro presented on April 14, 2020.

_____

Tracy Worrell, Ph.D.
Professor
School of Communication
College of Liberal Arts
Thesis Advisor

_____

Hans-Peter Bischof, Ph.D.
Professor
Department of Computer Science
Golisano College of Computing and
Information Sciences
Thesis Advisor

_____

Ammina Kothari, Ph.D.
Associate Professor and
Director of Graduate Programs
School of Communication
College of Liberal Arts

_____

Kelly Norris Martin, Ph.D.
Associate Professor and
Director
School of Communication
College of Liberal Arts

Acknowledgements

I would first like to thank my thesis advisor, Dr. Tracy Worrell for her guidance, patience, and ingenuity throughout this thesis process. She was the perfect thesis advisor; she kept a seamless balance of allowing me the freedom to learn and create while still keeping me on track and motivated. It is amazing what students can accomplish when their professors believe in them. I would also like to thank Dr. Hans-Peter Bischof for being the second reader on my thesis work. He is equally as kind as he is brilliant and his support of my work has been ongoing for many years. I also thank Elizabeth Reeves O'Connor for being the first professor I met in the School of Communication who believed in me, sparked my love of learning after many years, and continued to keep in touch to ensure I was still thriving. Additional thanks to Dr. Ammina Kothari for being such a strong and gracious leader to me over the last two years; it made me certain that I could complete this worthwhile research. Additionally, I am thankful for all of the other students in the CMT program. You welcomed me with open arms and encouraged me throughout my time in the program. Moreover, I thank my friends and family. I am so very blessed to have them always by my side. Lastly, I would like to thank my daughters, Abby and Rachel for always being there to support, enlighten, encourage and listen to me. You both fill my heart with joy and my life with purpose and laughter.

Table of Contents

Abstract

Utilizing the technology acceptance model theory (TAM), this study focuses on current digital communication tools used by those who are 65 and older, and the benefits and barriers of use. Using a mixed methods approach, individual interviews were conducted with those in this age demographic. The interviews captured older individuals' preferences of digital communication tools, their primary uses of these tools, and any barriers that hinder their use and acceptance. A survey of caregivers was conducted to gain their perspective on the benefits and barriers they see older people face when using digital technology media. The survey was sent to caregivers in their places of work, community groups, and educational learning centers who provide services to older adults. The survey provided information from the caregivers, which is lacking in the current research available. The results based on 30 interviews ($N = 30$) showed that the people in this age group use a variety of communication devices and rely on them. Their concerns and barriers were primarily with security and the continued training that was needed. They reported a lack of understanding about the inner workings of their equipment, and the need for a place or persons to aid in their training. There was also some discussion of physical limitations that they incur when using their devices, and trusting the internet with their personal information. There was also a correlation of level of education and use of these tools.

Keywords: digital, communication, older adults, benefits, barriers

Digital Communication Tools Used by Those 65 and Older: The Benefits and Barriers of Use

Those who are 65 and older are the fastest growing population in the world. According to the United States Census Bureau (2017), by 2030 the population of persons aged 65 and older will outnumber those under the age of 18. The increase in this demographic is seen globally and provides a vast resource for research. Persons 65 and older are also among those who are behind in their digital communication usage and skills (Aytuna & Capraz, 2018). The older adults are considered to be late adopters of technology. This means that they accept and utilize new technology later than the average person does. There is a digital divide among people and the older adults in our world are on the side of those who are less inclined to try a new digital technology tool. Digital technology can be defined as the use of any digital resource to find, analyze, create, or communicate information of any sort. While this population of individuals is increasing, their online interactions and digital communications are not keeping pace with the updates, security, and understanding of technology. Further complicating things is the fact that new technologies are transforming our world faster than most people can understand and use them (Gorbis, 2015). If those 65 and older are already lagging behind, it is important to research how to help them utilize and improve their digital communication skills, or they will lag behind in utilizing the benefits that the digital communication tools can provide. The digital literacy of those 65 and older is already behind in terms of acceptance. This means that older adults are less able to find, utilize, compose, and evaluate information through digital media. Using new digital communication tools and technologies forces them to struggle more than others outside their demographic (Schreuers, Quan-Hasse, & Martin, 2017).

Much of the research done about older adults and digital technology has focused on email and social media use (Chopik, 2016; Iqbal, Ahsan, Hussain, & Nadeem, 2016; Luders &

Brandtzæg, 2017; Tsai, Chang, & Ho, 2016). These two forms of digital communication can be used relatively easily with a limited number of interactions and are available for many people with an internet connection. There are numerous types of digital communication tools and there is growing research to look at this older population of adults and what can be done to shorten this digital divide. Along with email and social media research, studies have been done in the medical realm showing some barriers and benefits of use (Brox, Luque, & Evertsen, 2011; Iancu & Iancu, 2017; Parida, Mostaghel, & Oghazi, 2016; Tak, Beck, & McMahon, 2007). While these studies provide a wealth of information, more research is needed asking direct questions to people in this demographic and hearing their opinions, uses, needs, and desires. Additionally, there has been very little research done from the perspective of the caregiver. This study will provide both of these perspectives to advance our knowledge on the needs, benefits, and barriers of this older demographic in relation to digital communication.

Literature Review

There are many studies around the world that have looked at older adults and their digital technology uses and preferences. Since many of the people in this demographic did not grow up using these communication tools, they are divided from those who have had this experience. These older individuals can be considered disadvantaged from younger generations who have used digital technology in their schools, homes, and places of work and consider them second nature. Because these practical, relevant, and useful devices were not in existence or relied upon when these older people were growing up, accepting their usefulness can be difficult. Pursuing expertise on a computer, smartphone, or tablet in order to do your banking, shopping, exercise, and socializing was not necessary before, so why now? This is a barrier that must be broken down before older adults may desire to engage in using digital communication tools.

When people move from one country to another, they are referred to as immigrants. They are new to the culture and often need time to adjust to different ways to do things and interact with those in their new culture. So, too, are our older adults when using digital communication platforms. Media that most people rely upon every day to communicate, work, socialize, schedule events, and research can be foreign to our older population (Olsson, Samuelsson, & Viscovi, 2018). These older people can be thought of as "digital immigrants" (Lin & Chow, 2011). Comparing these older adults as immigrants with the current generation of "digital natives" showed that individuals who are 65 and older are not desirous of using digital media for communication, entertainment, and gratification. Individuals 65 and older seem to prefer television (TV) and face-to-face communication whenever it is available due to the familiarity of these options (Aytuna & Capraz, 2018). Older adults will use what they are familiar with and feel comfortable using. Older adults may find less barriers by using a device they are so familiar with (Depp, Schkade, Thompson, & Jeste, 2010). This is far different from the digital natives who almost, always prefer to use digital information systems. If we compare a person in their twenties with a person in their seventies, they may have vastly different habits in how they communicate, bank, shop, organize their calendars, and even interact with medical professionals (Aytuna & Capraz, 2018; Olsson et al., 2018). These habits or preferences have created a divide in their interactions with one another.

This demographic of those 65 and older are now considered to be the "second divide" when it comes to the digital technological world. The first divide in this area was in terms of the haves and have-nots. People who did not have, nor have access to, computers, tablets, cell phones, and so forth could not become proficient users just by their knowledge of their existence. Now that these digital media are so prevalent, the second divide, or grey divide, is due to a lack

of skills (Schreurs & Martin, 2017). Unfortunately, this is found primarily in those aged 65 and above (Niehaves & Plattfaut, 2014). The younger generations who have grown up with digital communication technology as part of their everyday life use it as a way of living, thinking, and problem solving. Having and using a smartphone is an amazing tool and therefore a priority for younger generations. Older adults use their digital technologies less frequently, making their daily interactions less dependent upon them. The use of a digital medium to schedule appointments, obtain news, shop, perform banking transactions, and socialize is not second nature, and the arm's length barrier furthers the grey divide (Olsson et al., 2018).

People naturally fear what they do not know or understand. Any new technology can cause people to be skeptical and the world of the internet is no different. The generation of people born in the last two decades have had the digital world of communication around them since birth. Using email, social media, cell phones, and other forms of online communication are less personal to the older members of our population. Preferring this type of communication when you do not see or hear expressions is a far different world of communication from those born in the 1950s or before. They tend to have more experience learning to trust people in person than they do in the digital world (Arfi & Agarwal, 2013). Their nature makes them more vulnerable. Trying to teach them to protect themselves while keeping their interest up is difficult (Kane, 2015). There are common cybercrimes targeting older adults. These crimes include (a) health care fraud or health insurance fraud, (b) medical equipment fraud, and (c) telemarketing fraud (Arfi & Agarwal, 2013). When older people do fall victim to cyber-crimes, they are less likely to report it, feeling somehow responsible for not knowing better. Each time an older person experiences difficulties when using a technology can further the grey divide that already exists.

Barriers of Digital Technology Use for Older Adults

Older persons can have greater physical and cognitive limitations. Inacu and Inacu (2017) identified the following physical restrictions faced by older adults. Vision is a primary limitation as most people over the age of 55 need glasses. Their field of sight is just one part of this limitation. There is also a change in their sensitivity to light, color, and pattern recognition; about 35% have reduced hearing, which could impede their learning. Another area is their flexibility; there is a loss of strength in limbs and reduced hand to eye coordination. They have lost about a third of their overall muscle strength. Fine motor skills are also reduced. Reduced dexterity in their fingers and limbs make it difficult to push buttons, scroll, or use a mouse (pp. 3–4). Therefore, the use of technical devices that require the most dexterity and physical mobility are the most difficult to use. Lastly, cognitive abilities are often impaired and short-term memory skills are diminished. These combined limitations impact the ability to use a mouse, cell phone, touch screens, keyboards, remember directions, and hold things securely.

Socioeconomic barriers also exist. People from less privileged societal positions are less likely to use the internet and partake in fewer capital-enhancing activities (Hargittal & Dobransky, 2017). Therefore, the digital divide that already exists is larger for some than for others. The more technologies you can afford the more you may feel comfortable using. Usage is not enough to maintain proficiency though. Understanding the need for regular updates of software, security measures, and the importance of changing passwords or two-factor authentication are also part of usage and mastery. Those who are at the lower socio-economic classifications may struggle financially to keep up with all of these necessary rules and technical support needed (Hargittal & Dobransky, 2017). Those who are the oldest in this demographic

often struggle the most. Those who were already 65 or older when the internet became widely used have the poorest digital skills (Hargittal & Dobransky, 2017).

Even with desire and opportunity there are other barriers that prevent digital technology use and acceptance. According to the U.S. Department of Health and Human Services, there are 15,600 nursing homes with 1.4 million residents in the United States (National Center for Health Statistics, 2018). The perceived barriers of computer use and internet access by administrators of nursing homes are almost equal to the benefits (Tak et al., 2007). Physical limitations, accidental virus downloads, illegal computer activity, and purchasing unaffordable items are common reasons for the resistance. There has been a shift in this thinking, but it is moving slowly and technology is gaining and changing each year (Tak et al., 2007).

Benefits of Digital Technology Use for Older Adults

Understanding these physical and cognitive barriers, the choice of which digital communication medium is used makes a difference. Social networking technologies and platforms are often the digital communication tool of choice. Older individuals see a benefit to staying in touch with friends and family and supporting their outside interests using social media (Chopik, 2016). The ability of the digital world to influence socialization for the older adults seems endless. The world of a senior citizen can naturally shrink over time as peers and partners die. Retirement from work can be a great opportunity and wonderful freedom, but it depends upon the terms of the barriers described earlier. Physical or cognitive limitations tethered with a loss of social and work companions can cause loneliness or lethargy; combating these problems with computer-based interventions improves connectivity to others (McCausland & Falk, 2012). Any additional obstacles to freedom such as not being able to drive can further feelings of isolation. Social network sites (SNS) such as Facebook provide avenues for socialization and

building friendships that may have been lost by older individuals in everyday life. Staying in touch with loved ones, a group, or club of a common interest can be accomplished online (Yu, Ellison, & Lampe, 2018).

Along with the benefit of using social media technologies to stay connected to people, it also decreases loneliness and depression (Chopik, 2016). Better overall health, fewer chronic illnesses, and lower feelings of depression were associated with greater technology use (Chopik, 2016). There have also been some recent studies (Holden & Karsh, 2010) regarding digital technology communication and the medical field relating to older adults. Robotic pets that can aid with reminders to take medicine, store information, and provide a level of companionship are recognized as valuable. Digital communication that directly conveys medical information from older patients to medical professionals provides ease of mind and less opportunities for misinformation (Subagdja & Tan, 2015).

Digital technology and the health industry are working together to make physical activity more attractive and desirable. Exergames are increasing in popularity for the older adults. Online or virtual games, such as the Wii, can increase physical and mental stimulation (Brox, Evertsen, & González-Hernández, 2011). These games are being adapted to benefit an older demographic. Increasing mobility, dexterity, and the basic fun of playing a game can persuade older people to be active. The social aspect of doing this with others should increase the desire for this interaction (Brox et al., 2011).

There is also research being done with patients who suffer from Alzheimer's disease and dementia. The use of a tablet for patients who can no longer speak was found to be beneficial in communicating. Pointing to pictures or interacting with a tablet can allow the conversational partner to have an additional communication tool (Ekstrom, Ferm, & Samuelsson, 2017). Tablets

in particular are often preferred by those 65 and older over smartphones for exploring the internet, reading, news, and social media. They have larger screens and buttons so they are beneficial to weaker eyes and arthritic fingers (Pew, 2017). Lastly, for those who are using digital communication tools, it provides a sense of independence and autonomy. Connecting with friends and family, researching, obtaining news, and health information using the often-preferred methods of those you are interacting with brings a sense of accomplishment (Chopik, 2016).

Theory

The acceptance of any new technology will have a learning curve for those in the grey divide. Predicting the acceptance of the new technology can be measured using the technology acceptance model (TAM). This theory was first examined by Fred Davis in 1980 as part of his doctoral work at MIT. TAM states that a new user must both believe that the technology will benefit them and that it will be easy enough to use to make investing their time and energy worthwhile. An older person's perception of the new communication technology will affect their desire to learn about it (Luders & Brandtzaeg, 2017). Any pre-existing feelings of inadequacy to understand or use the new tool hinders their desire to invest themselves and make it part of their lives. Any new communication tool must be perceived as both worthwhile and beneficial to them. It must be easy enough to use so that any physical or cognitive limitations will not hinder use. It must also benefit them in a way that it overrides any initial hesitancy or preconceived notion about difficulty of use. It is not just enough to tell older individuals that they will enjoy using a tablet, cell phone, or other device; they must buy into this belief. Complicated instructions, or instructions not easily remembered, will likely impede acceptance.

Previous research related to older adults and technology has focused on social media usage, email, and health related benefits and barriers. It is as important to know what to say as

well as how to say it. TAM states that acceptance comes from immediate benefit, limited learning curves, and relatable speech. As with all people, learning for the older individuals should be done in a way that does not make them feel ostracized or objectified. It should be done in a comfortable setting, and when possible, they should learn as part of something else enjoyable such as time spent with a loved one or friend. The person instructing must remember that terminology that is second nature for them may be heard as if in a foreign language, with little or no understanding. The setting where the instruction occurs, such as a classroom or library hall, can make them feel out of place. The persuasive message needs a buy in from the person being taught (Schreurs et al., 2017). Moreover, some older adults feel that to immerse themselves in the digital world, especially social networking, they are attaching themselves to something bad. They relate the social networking sites world to time spent talking about yourself to others or gossiping. The idea of replacing the face-to-face world they love with a technology seems wrong (Ludens & Brandtzaeg, 2014). Not relying on information technologies (IT) in the past makes the desire to cross this divide difficult (Niehaves & Plattfaut, 2014).

Using a social media technology such as Snapchat and Instagram have shown that acceptance of a new technology is based on desire to use it and the possible benefits it will bring the user (Doleck, Bazelais, & Lemay, 2017). Platforms that primarily use photos and imagery show that acceptance happens more quickly. The need for self-expression is strong and the driving force behind technology acceptance (Doleck et al., 2017). The fast nature of posting a picture on a platform, such as a selfie, gives instant gratification and speaks faster than a story. This has been further confirmed by surveys conducted on South Korean college students who rate the entertainment and self-expression values to be highly considered when using platforms

such as Instagram (Hwang & Cho, 2018). Any concerns for privacy or other risks that may occur when sharing pictures of themselves are secondary to the instant gratification.

Understanding all the possibilities, we must also understand that bringing on all of the virtual and digital possibilities at once can be overwhelming. Exposing older persons to many forms of technology all at once can prove to be overwhelming and have the opposite effect of acceptance. Explaining one desired technology function at a time has the best chance of having the person actually adopt the behavior (Subagadja & Tan, 2015). Explanations should be done in a variety of ways to have the best chance of the acceptance.

As noted in the barriers section of this paper, there are security risks that older adults face related to security and cybercrimes. Studies specifically related to digital immigrants and their awareness of internet dangers and risks are plentiful (Kane, 2015). Cybercrimes are targeted towards those with the most vulnerability and least digital knowledge (Arfi & Agarwal, 2013). While there is free educational opportunity for digital learning seniors learn best from friends and family in a relaxed environment (Zulkifli, Noor, Bakar, Mat, & Ahmad, 2015). Healthcare and health insurance fraud are subsets of cybercrime that target the older adults. Telemarketers also reach people who open email and answer the phones as these older, trusting seniors tend to do (Arfi & Agarwal, 2013). There are approximately 230,000 new instances of malware bugs sent out on a daily basis and ransomware infections grow by about 4000 instances every six months (Pew Research Center, 2018).

Social, mental, and physical limitations are considered when making suggestions on acceptance. People 65 and older are more likely to use technology when it fits in with their routines, and when any benefit outweighs the possible frustration of learning how to use it (Iancu & Iancu, 2017). Since digital literacy is a learned skill, access and encouragement must be there

to influence behavior. The digital chasm that seems to exist right now will shrink as the current technological savvy generations age. However, as noted earlier, technology is changing at a rate faster than most people can adopt or adapt to.

Research Questions

In light of persons 65 and older growing at such a rapid rate, it is vital that research is done to find out what digital communication tools are most beneficial and what efforts can be made to ensure acceptance. Drawing on the framework of TAM and scholarship in digital communication and older adults, this study will be guided by the following research questions:

RQ1: What type of digital platforms are being used and why they are preferred?

RQ2: What hinders older adults in accepting a digital technology medium and what would eliminate these obstacles in order to allow benefits and usefulness to prevail?

RQ3: What do caregivers see as the benefits and barriers for older adults and their use of digital technology? How could the caregiver aid in acceptance?

Methodology

This study used a mixed-methods approach for collecting data. Both interviews and a survey were used to obtain information about adults who are 65 and older and their uses of digital communication tools. The interviews were conducted between February 23, 2020 and March 13, 2020, and were primarily conducted in the Rochester, New York area. The first two research questions required a personal and primary perspective of the individuals in question. A qualitative research method provided the best option for gaining the answers. Thirty personal interviews were conducted with individuals aged 65 and older. This method allowed for a comfortable and relaxed atmosphere that provided more detailed answers, and room for a conversational approach and clarification to be used when needed. For persons in this age group,

personal interviews brought a level of trust and could be completed in a location where the interviewees felt secure. These interviews were conducted at local community centers, Osher Learning Institute, local libraries, Lifespan locations, and in private homes. Direct questions were asked in an interview style but respondents were allowed to expand as they wanted when answering. The interviews were recorded for accuracy and then transcribed using an audio transcription service, TEMI. The transcriptions were then downloaded and saved as documents, and reviewed against the original recordings to correct any errors. The results were then put in an Excel spreadsheet to find commonalities.

Measures

Interviewees were first asked their age and highest level of education. This was done to see if there were possible correlations to education level and desires or decisions to engage with digital communication tools. Next, respondents were asked about which digital communication tools they use. This question focused on the platforms of daily technical communication tools such as cell phones. “What kind of digital communication tools do you use?” was asked to each respondent. Once a list was noted, interviewees were asked more about the devices selected. Respondents were then asked “Why do you use this device?” so preferences could be established and then expounded upon. Each tool was then reviewed for specific preferences such as convenience, size, ease of use, portability, and so forth. Once an understanding of preference was established, a pattern could be looked for among the respondents.

Interviewees were then asked to consider other devices not listed. They were asked “Are there any other devices you would like to use but do not?” Along with this question, respondents were asked “Are there devices you have tried and decided not to use? If so, why?” From this

discussion, an inroad to detect and dissect possible barriers was established. Any devices tried and discontinued were investigated with questions about what barrier was found.

To establish a connection of the use with their device, respondents were asked “What do you use your devices for?” If there was a limited response, alternate ideas were offered to find the most possible and preferred uses. For example, if an interviewee stated that they used their tablet for emails, shopping, and research, a follow-up question would be “Do you ever use your tablet for scheduling appointments or other calendar events, social media, banking, or playing games?” Answers were noted and then expanded further if any of the items were chosen. This gave a broader list of uses, but also communicated what was the primary use that came to mind by the interviewee.

Next, respondents were asked about their comfort level and knowledge about their devices. They were asked “Do you feel knowledgeable about your devices?” This allowed for a better picture of satisfaction level with the device as well as additional levels of possible barriers of use. Lastly, respondents were asked about specific barriers in questioning, “Are there any barriers you have found when using each device?” After this, they were given examples of physical, cognitive, and security barriers that they faced or that concerned them. This last area opened up a wide variety of possibilities in their responses.

The interviewees were made to feel as comfortable as possible and were assured that they did not have to partake in the interview. Additionally, they were instructed that they could end the interview at any time, even if the interviewer had additional questions. The interview questions were delivered in a calm, clear, and conversational manner, and interviewees were encouraged to ask for clarification when needed. Utmost respect was shown to all participants at all times, and feelings of confidentiality were upheld.

Caregivers

The third research question needed to be answered by looking at a variety of persons who provide care to these older individuals. A quantitative approach for this collection of data allowed me to reach people in a variety of settings both in the local area and farther away. A survey was created and sent via email to a variety of senior living centers, Lifespan, private caregivers, and nursing home administrators. These included family members, health care professionals, and paid companions. The method of a survey for the caregivers was preferred as they could provide perspectives on the benefits and barriers of digital technology that they have observed. This method was less invasive and time consuming, and allowed for participants to share their expertise while still adhering to their professional and legal responsibilities. This networking sampling was used and could then be sent from one person to another by providing a private and confidential link to the survey.

Questions in the caregiver survey pertaining to social and socio-economic benefits and barriers were also asked for if known. This information will help to direct future efforts that could be taken to ensure acceptance and convey the benefits of digital technology use. All persons who were surveyed or interviewed gave their permission and were instructed about the use of this material for thesis presentation.

Procedure

The chosen organizations were contacted via email or phone to request access to participants, and to discuss the specifications of the minimum age of the participants, ability to gain consent, and complete details of the use of the responses for research purposes. Caregiver participation was directed through the organizations they are associated with and was voluntary.

Respondents of the survey were asked a variety of questions to glean their observations and expertise about older adults' use of digital communication tools. Each answer was then charted for comparison.

The first questions asked were related to the age of the individuals and their living environment. Respondents were asked to provide the age range of those in their care, such as 65 – 70, 71-75, and so forth in five-year increments up to 93 and above. They were also allowed to write in a specific age in the event they only cared for one individual. Next, they were asked to select where this care was given (e.g., nursing home, assisted living facility, in home care, etc.) to provide a possible correlation between the answers and the living environment.

Respondents were questioned about which digital communication tools were seen used by the older adults in their care, and which tools were used most often. The caregivers were asked to select the preference of media used by the older adults. This was based on frequency or actual communication with the older adult. There was also an option to write in another media not listed in the multiple choices listed.

Respondents were then given specific questions to determine their knowledge about what benefits and barriers they saw older adults experience when using digital technology devices. Specifically, "What are some of the benefits you see these older individuals experience by using these digital communication tools?" The answers could be selected from eight possible benefits, such as decrease loneliness, improve cognitive abilities, and so forth. These choices were selected from previous research about the benefits of digital communication technology use, and respondents could choose multiple options. Similarly, they were then asked about barriers with the question "What, if anything prevents older adults from using digital communication tools?" Answers were from categories such as physical limitations, technical questions or problems,

preference of use, and so forth, and multiple options could be selected. For any responders who selected physical barriers, a further question was asked. This follow-up question asked about the greatest physical deterrent to physical deterrent, giving five possible categories of (a) vision, (b) hearing, (c) dexterity or fine motor abilities, (d) cognitive or memory related, or (e) other.

To gain insight into the possible barrier of technology being too difficult to understand or use, caregivers were posed the question, “Have you provided care for an individual who does not use digital communication tools because they don’t understand how to use them?” in a yes or no format. If yes was selected to this question, a follow-up question asked “What percentage of individuals do not use digital communication tools because they don’t understand how to use them?” A choice of five different percent ranges was offered for this question.

The question “Have you provided care for an individual who does not use digital communication tools because they are concerned about the security risks involved with their use?” was asked to the caregivers. Respondents could answer yes or no. For those who answered yes, a follow-up question asked “What percentage of individuals do not use digital communication tools because they are concerned about the security risks involved?” Answers could be selected in 20% increments.

With regard to more technical questions, caregivers were also asked, “Do you think older adults have enough technical support to be proficient in using their digital communication tools?” The answer was again a yes or no format. Additionally, another question related to technical tools asked “Do you believe that there are medical devices that could prove useful for this demographic but are too technologically difficult for the elderly to use?", again offering a yes or no response. Relating to this medical aspect, if yes was selected, a follow-up question as to why they thought this was asked with a four-option answer, which allowed for multiple

answers. The last question in this area was “Who should provide this technical support for these older adults?” There were four possible answers including (a) friends and family, (b) community organizations, (c) local government, and (d) places of residence (nursing homes, assisted living). There were two questions related to the socio-economic status of the individuals under their care. They were “Which of these attributes is affected by an individual’s level of education?” and “Which of these attributes is affected by an individual’s monetary resources?” The options for both answers were (a) desire to use the digital communication tool, (b) ability to use the digital communication tool, and (c) neither of these attributes.

The Qualtrics survey was 20 questions in total, including the skip logic used when a specific answer to a question brought them directly to a following question.

All of the research was conducted using the specific requirements of Rochester Institute of Technology rules and regulations and with approval from the Institutional Research Board.

Results

The older participants were individuals between the ages of 65 and 95. All but four of the respondents had a college degree of some level and 14 had a Master’s degree or Ph.D. All but one individual had a high school degree. The next section presents the exact findings.

RQ 1

Research question one asked which types of digital platforms are being used and why they are preferred. Based on the results of the interviews, the preferred digital platforms used by older adults are cell phones, laptops, and tablets. This was mainly due to the convenience and portability of these devices. Results showed that 29 out of 30 individuals used at least one digital communication tool. The only individual who did not own a cell phone lived alone and said they had tried one but did not understand it and so gave it back. All other individuals interviewed had

a cell phone and used it mainly for ease of communication from any location and the sense of safety and security owning a mobile device offered. Of the 30 respondents, 16 reported having laptops and 12 reported having tablets. Some interviewees had both of these and two had more than one tablet. One 82-year-old stated, “I have both, but have not used my tablet since getting my new Mac Book Air.” There was only one individual who had a smart watch, one who had hearing aids hooked up to their smart phone, and few respondents with desktop personal computers.

Cell phones were mostly smartphones and were primarily used for daily communication: (a) phone calls, (b) texting, and (c) for contact storage. Some additional uses were for Google Maps, social media, email, and games. One 77-year-old said, “I enjoy the freedom of screening calls.” Another stated, “I love the texting feature because I hate talking on the phone.” Having a way to immediately contact someone in an emergency situation was of comfort, but several people commented negatively about feeling the need to carry them all the time. An equal number of people had them immediately in front of them during the interview as did have them stored safely in coats, bags, or purses. One individual stated that they “had a cell phone for emergencies and did not really like to get calls when away from the house.” Another 75-year-old who is mostly housebound with many physical afflictions stated, “I prefer using my home phone (land line), I only take the cell phone when I leave the house, but I mostly use it for emergencies.” One 77-year-old who uses their laptop regularly for research and information stated about the cellphone that, “I don’t like to have to be carrying anything around that is like a delicate child.” On opposite sides of the spectrum is one individual who stated, “Phones bug the piss out of me.” While at the other end is a 95-year-old individual who uses their iPhone to FaceTime daily with their spouse who is living in a different facility.

Two individuals commented on being frustrated with Apps. Specifically mentioned was the Wegmans grocery store App, which had recently changed. The App is more complicated, the selection buttons are smaller, and therefore, makes it less desirable to use. The security that a cell phone brings seemed to be appreciated by almost all the individuals who were interviewed. Although, there were still a few who did not like the idea of being tethered to them.

Laptops and tablets were very desirable among these individuals. Most preferred them to their cell phones as they had bigger screens and keyboards. They are easy to carry around and were reported as valuable especially when traveling. A recently retired 67-year-old said, "We travel quite a bit now and I take my Chromebook with me. I love to have it when traveling." When asked what respondents use their laptop for, one 87-year-old declared, "Oh my God, everything!" This was true of most of the individuals that were interviewed. Most popular uses were related to information gathering. There was a sense of being able to find things out at a moment's notice that was palpable for those individuals who discussed these devices. Aside from news, research, and subscriptions that were popular, email and shopping were also highly reported. The variety of uses included (a) an 82-year-old who had 1100 CDs and radio broadcasts stored on their laptop and also maintained a website; (b) an 87-year-old who watches YouTube videos on sewing, knitting, and cooking; and (c) a 71-year-old who looks up information on Cricket. "I would be totally lost without my laptop computer," stated a person with very limited mobility, "It is my connection to the outside world."

The preference between laptop and tablet seemed to be the laptop. Although both were discussed, the laptops were used for a few more things, specifically emails or longer "letter writing," banking, and general research. The tablets held more use for downloaded books and shopping.

RQ 2

Research question two examines what hinders those 65 and older accepting a digital technology media and what could eliminate these obstacles in order to allow benefits and usefulness to prevail. According to the interviews conducted, older adults are hindered in their acceptance of technology due to a lack of understanding of their media tools and in trusting that they are secure when using them. Physical barriers were also reported, primarily with vision and dexterity. These obstacles would be eliminated if there were more people available to aid these older individuals in their understanding of each device and to modify them, when possible, to meet their individual needs. Lessons on security, passwords, and online safety need to happen more often and be offered at a variety of levels, starting at a novice, or perhaps, immigrant level. Physical barriers can be aided by offering variations when creating Apps or other software.

Hindrance 1: Understanding their devices. Most of the respondents noted that although they use their devices daily, they only feel knowledgeable about what current tasks they use them for. They do not feel competent when it comes to knowing all that their tools can do. They were not sure of what software their machines use, when to upgrade, and what security measures should be taken. They do not know how to remove Apps that come with devices or how to reorganize things on their screens. Concerns about the camera were mentioned a few times. Understanding how to change their camera from photo to video, and understanding how to send attachments were all noted as specifically frustrating. One 76-year-old said, “Things change too quickly; what works today doesn’t work tomorrow. Not all things are worth the effort but I need to keep up with **everything** to be able to use **some things.**” A 73-year-old stated, “The devices are so complicated, the more bells and whistles, the more that can go wrong.” A tragic example of this scenario is from a 78-year-old, who stated,

> I want to share things that I enjoy with other people but I don't know how. Mostly, it is just remembering how to do things with it (laptop). When calling a support line for help, I was asked, "Do you know this is the 28th time you have called in two years?" so, why would I ever call again?

There is pressure to stay up to date with security, but it is overwhelming. More than fifty percent of interviewees specifically stated their worries about security. A 77-year-old shared that they had been the victim of cybercrime and $2,000.00 had been stolen from their bank account. Security updates, password compliance, and encryption are recommended for most online transactions these days. They stated, "I can correct a bad decision, but I cannot correct indecision." The need to be current with security requires some degree of understanding about both your devices and the invisible criminals online. Several people indicated that keeping updated on security, backups, and upgrades have become more difficult since leaving the workforce. Since retirement, there are not as many individuals out there to help. One person stated, "Nothing comes with a manual anymore, everything is a pdf you have to access." Two people in their seventies said that when they were working, there were always people to ask and get help from, people who cared about you and your success. One stated, "Now, there are high school students at the library and they will teach you, but they make you feel about this big" (holding her thumb and index finger about a half inch apart).

Passwords were noted several times as too difficult to remember and the desire to use the same one for everything was tempting even if not recommended. After attending a course on cybersecurity, many of these older adults talked about being even more confused with the three-page handout that was meant to help them.

Hindrance 2: Physical limitations. Several individuals reported that their vision was problematic when using some of their devices. They complained that the screens and buttons were too small. One 65-year-old said that it was frustrating when "it tries to guess what you want to say and auto fills or auto corrects. I have to check everything very carefully before I send it." Another individual stated that three of their digits do not work well and were not recognized by their phone so they could not use them for activating it or typing. Several individuals reported preferring their larger screens on their tablets and laptops because of the benefit of a larger screen. When asked about the physical barriers, if any, an 85-year-old stated, "I have all of the physical barriers, problems with vision, hearing and dexterity, but I deal with it, it is part of everyday life." Another 69-year-old said, "sometimes the buttons or words are too small, but use my reading glasses for most things, so for that I get by." Respondents are used to dealing with some physical barriers, such as decreased vision, but they have that with all areas of their lives, not just digital communication media. It is expected to some degree, so less of a hindrance. It is expected and if wearing reading glasses brings relief, it is not too inconvenient.

RQ 3

Research question three turned to what caregivers see as the benefits and barriers for the elderly and their use of digital technology, including what could be done to increase acceptance. To obtain answers to this question, an electronic survey was sent out to agencies that employ individuals who are caregivers for this age group. There were only 16 respondents due to a pandemic of the Coronavirus (COVID-19). Agencies stated that they were too busy to take the survey or push for others to do so when their main concern was for those who are vulnerable and at high risk for this virus.

In response to research question three, of those that did respond, they cared for people who were between the ages of 65 and 94 in nursing homes, in-home care, and other locations. They reported the greatest benefits of technology to the patients were decreasing loneliness, improving mood, and staying connected to others. The greatest barrier to using the technology was technical questions or problems with their tools. Secondary barriers were physical limitations and a lack of preference to use a particular device.

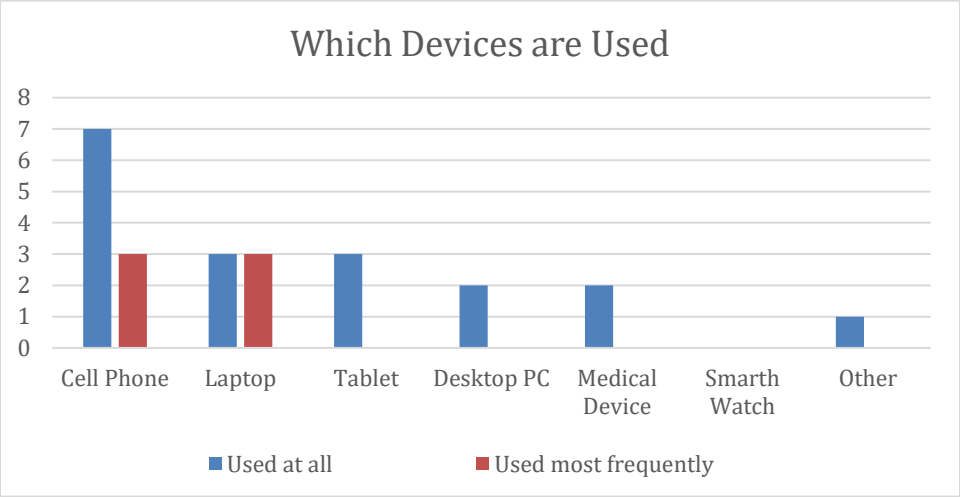

Figure 1. Caregiver responses of what digital media are used.

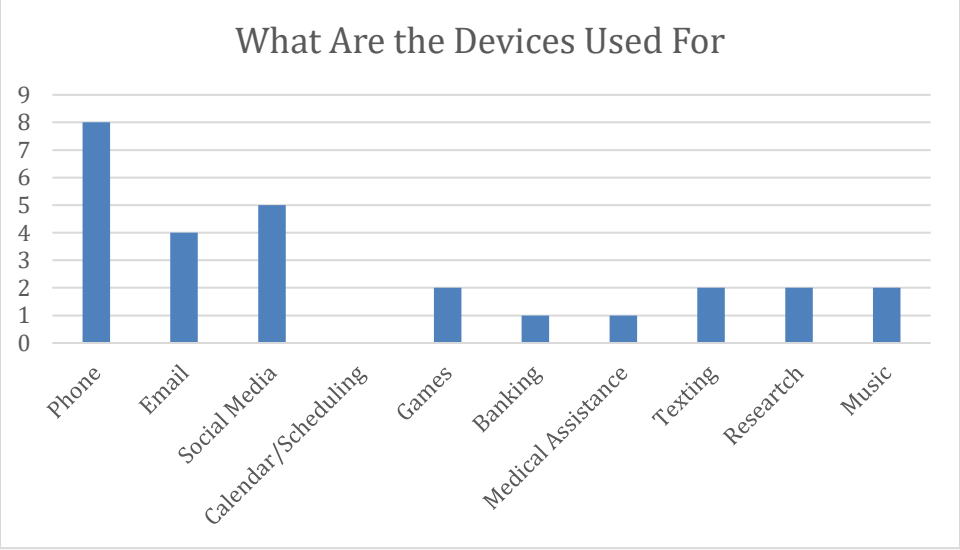

Figure 2. Caregiver responses of what digital media are used for.

Figure 1 shows that caregivers reported that phones and laptops are used with equal frequency by those they care for. Figure 2 shows that caregivers reported digital media was most often used for phone calls and secondarily for social media. Figure 3 reflects that caregivers observed some physical limitations that could interfere with use and acceptance of digital communication tools.

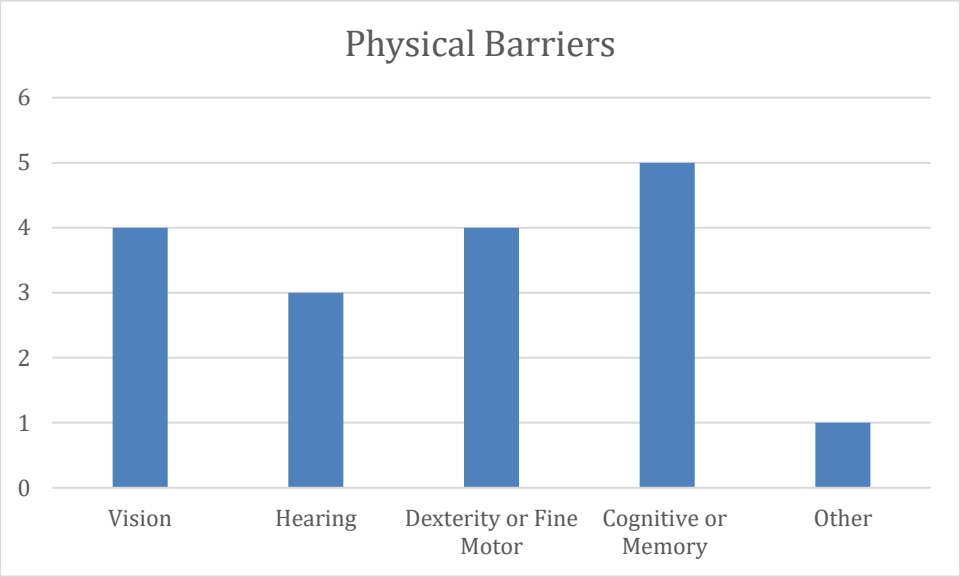

Figure 3. Physical barriers noted by caregivers.

The physical limitations were found to be caused by cognitive or memory related issues followed by vision and dexterity/fine motor abilities. Caregivers reported that neither desire nor ability to use digital communication devices were affected by monetary resources. They did, however report that levels of education made a slight increase in both desire and ability to use these digital media tools, with desire being the higher of the two. Almost all respondents reported that they have provided care for an individual who does not use digital communication tools because they do not understand how to use them. Fifty percent of their patients have concerns about security risks. Most do not believe that their patients have enough technical

support to be proficient in their use of their digital communication devices. A majority responded that they believe that there are medical devices that could prove useful but they are too technologically difficult for older adults to use.

Due to the COVID-19 pandemic that severely limited the responses to this survey, there are not enough results to generalize. Caregivers were suspended from taking or forwarding this survey so they could focus on the individuals in their care. Future studies should further explore this area as it could provide great insight to understanding how to narrow the digital divide. From the few responses that were given, these caregivers see that older adults need assistance in understanding how to use and maintain their devices. Physical limitations that come with aging are expected. Older adults can be accommodated when using their preferred communication tools, even when there are physical barriers, if we can prepare for them in advance, and when creating these devices.

Discussion

This study looked at the digital communication technology tools used by those 65 and older. Specifically, what media they used, why these media are preferred, and what benefits and barriers there are to using them. Additionally, there was an attempt to gain the perspective of the caregivers who aid many of the people in this age demographic, but the results were quite limited.

The interviews conducted showed that as our aging population grows, their use of digital communication tools are growing as well. Although the digital divide still exists, many older adults are working to be included in the ever-changing digital world. However, in order to stay connected, these individuals need a reason that supports desire and benefit. The findings from this research show that these individuals are interested in being connected. They want to

communicate from anywhere, have access to information at the click of a button, have the convenience of finding and sharing information, have access to shop, be entertained, and be easily linked to family and friends. Clearly, the desire is there. But, this is only one half of the equation. The other half is the belief that the effort put in to learning how to do all these things is worth the effort to learn. This is where we find some obstacles. The major dilemma is that the tools being used are complicated, require frequent updates, password protection, and knowledge of security. These areas cause frustration, fear, and hinder acceptance.

These results directly support the TAM Theory which states that individuals will accept a new technology if they both believe it will be beneficial to them and it will be easy enough to use to make the learning worthwhile (Davis, 1980). For these adults, the desire was often there, but complicated instructions, failure when trying a device, and lack of caring, consistent trainers were causes for some lack of acceptance.

Physical barriers do exist and cannot be ignored. Based on this research, there seems to be a correlation for individuals who are under the care of others versus those who are living independently. For those who were interviewed, these barriers, even for those in a wheelchair, were more an accepted part of their life and not strictly a barrier. Some remarked about their physical ailments as frustrating but did not prevent them from using a particular device. The desire to work with the physical limitation and still use the media was evident. The Caregiver survey listed equally vision, cognitive, and dexterity as preventing use. This correlation may relate more to the older adult's level of digital immersion, independence, and comfort level, than actual barriers. Familiarity with a particular media before going into a situation where care was required may benefit or impede future use. For those who are living independently, there are more opportunities to learn and become familiar with their tools. The interviewees were all able

to be out in public settings, learning communities, and group gatherings. There was not a dependence upon another individual for their care, and therefore, the correlation between being cared for and caring for oneself should continue to be explored.

Knowledge of training, security, updates on equipment, and problem solving when issues occurred, were the larger issues discussed in the interviews. Fear of causing more damage and a lack of general understanding of their products caused greater trepidation. This was lessened for those who are still working, have some built in support, and can more readily find assistance when needed. Additionally, some individuals who are retired have social activities that require them to keep up to date with relevant technological knowledge. In essence, enticing them to find solutions when necessary because they were motivated to. Motivation has an influence on the effectiveness of learning (Zulfiki et al., 2015). The more motivated they are to use a particular media for their benefit, the more likely they will be to learn and accept it.

Using digital communication devices is a continual process. As the world changes, these devices change as well. It is not just a lack of familiarity with the technology; it is also the need for security awareness training that must continue for usage to remain constant. The interviewees gave clear indications that these security issues were of great concern to them. Security training must be done in a manner that provides great encouragement and care (Arfi & Agarwal, 2013; Kane, 2015).

Almost all of the individuals interviewed had high levels of education; some were interviewed at learning centers or community centers that have educational programs. This research showed another correlation between level of education and acceptance of technology. Attitudes toward learning, and acceptance are influenced by levels of education. Those who are more highly or better educated have more positive attitudes toward communication technologies.

There is a greater openness to learning new things and a greater curiosity (Zambianchi, Ronnlund, & Carelli, 2019).

Several individuals mentioned that social media sites were not of great importance to them during the interviews. They did not enjoy spending time on these sites, and if used, felt compelled to be on them to connect with family members or friends farther away. There were some who tried some of the sites and then stopped using them, or left their accounts open but rarely use them. There is a balance of usefulness and keeping in touch with loved ones, and also an infringement into their privacy and time constraints. Those who use social media must find it useful and not intrusive (Iancu & Iancu, 2017).

On the other hand, the caregivers' responses indicated that connection through social media can reduce loneliness, depression, and elevate moods. There are several health related benefits associated with technology use, particularly social media sites. For those older adults who have limited socialization opportunities, social media can help these older adults find connections and prevent the feelings of isolation (Iqbal et al., 2016). This is further supported by other research that suggests that these interactions have a powerful and positive impact on older adults (Yu et al., 2018). There are many reasons why this connection between elevating moods and combating loneliness is connected with social media. As discussed earlier, there are a number of physical limitations that occur through the aging process. Those who have physical weaknesses may be forced to be less mobile and have less opportunities to interact with others. Combining these physical impediments with retirement and death of a spouse and/or peers, the networking and socializing opportunities can wane as well. Finding ways to socialize through social networks seems a logical place to look to decrease loneliness and interact with others.

These divergent responses continue to show the differences between those who are living independently and those who are in need of others to care for them. Those who have a level of independence may be more likely to use their devices for different things. If someone is more isolated, the connection of social media may seem inviting and motivating. For someone who is able to take classes, drive, and socialize in other locations, social media may be less intriguing.

In speaking with the owner of a local nursing home, very few of the residents had any digital communication devices and if they did, typically, they used cell phones for phone calls and sometimes a FaceTime visit from loved ones far away. He indicated that this was a trend of nursing homes and that they were far different from the growing number of assisted living facilities where people can live independently or semi-independently.

Conclusion

According to the United Nations World Population Prospects 2019, the oldest individuals will become the largest demographic (see Figure 4).

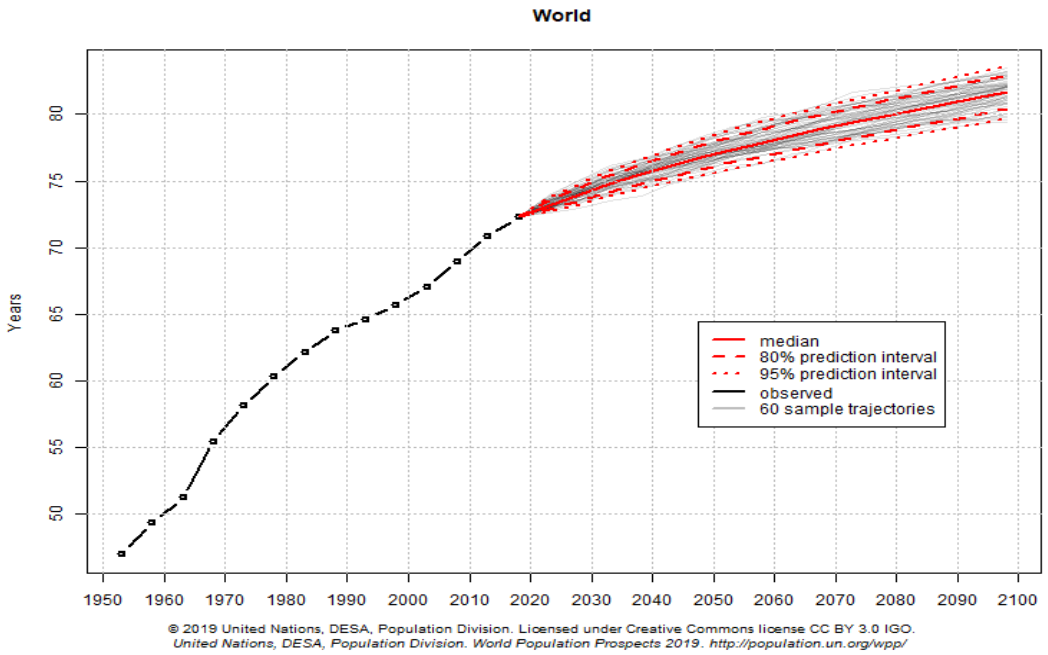

Figure 4. Predictions of world population median ages.

The demographic of older persons needs to be included as we move forward in our ever-changing cyber world. Our countries, governments, and communities should take an interest in protecting and teaching this generation. These twenty-eight million people should be considered when technology is created, advanced, and improved. Moreover, we cannot lump all people aged 65 and above into one homogeneous category. Physical limitations aside, there are more complexities which affect their ability to adopt, accept, and adapt to new technologies. technologies, and this vast and complex group of individuals. These older adults are engaged, creative, capable, and working to stay connected to our digital world by adapting to it, even with their barriers and limitations. Those who are not yet in this age range, likely will be someday and will need these digital inroads paved with expertise and care. Socioeconomic factors, education, and disabilities all add to the makeup of this grey divide and must be looked at more closely. Lastly, the caregivers who work with older adults on a regular basis should be given a voice as to the challenges and advantages of digital communication

Limitations and Future Research

This study was limited in the caregiver aspect due to the pandemic Corona Virus (COVID-19) which was sweeping the country when this research was being conducted. Employers and facilities would not send out the survey to their caregivers as their time and talents were needed to care for these vulnerable people. Although I was able to email the owner of 19 nursing and assisted living facilities and speak on the phone with an owner of one nursing home, the caregiver information could not be properly obtained.

A further limitation was that a wider variety of places to interview participants would have given a broader range of results throughout the greater Rochester area. Participants were mainly found in community locations, which meant that most individuals had a level of independence and ability to participate and understand. Those who may suffer some cognitive or other physical barriers were not as prevalent. Generalizations could not be made from the caregiver survey results, so no quantifiable results were obtained due to the number of responses.

Most assisted care facilities will not allow residents to participate due to HIPPA laws and permission of family members or financial overseers; this further limited an entire group of people who would have been interesting to add to the demographic. In addition, nursing homes no longer have many patients who are physically or cognitively capable to undergo interviews without supervision and additional time.

Furthermore, the results were primarily from one county in the United States that has been known to be quite white collar and rich in education and business when these interviewees were younger. This may have led to similar outcomes.

Future research must be done to incorporate the caregiver's knowledge into our search for understanding on the benefits and barriers that our older adults are facing. These people, who

require caregiver support, have the least independence and may have less opportunities to learn and incorporate digital communication technologies into their lives. Lastly, a greater and more diverse population of individuals should be interviewed to allow for the maximum benefit of this important research.

References

Aytuna, N., & Capraz, Y. C. (2018). Uses and gratifications of internet use among the elderly in Turkey. *Athens Journal of Mass Media and Communications*, *4*(2), 109–120. doi: 10.30958/ajmmc.4.2.2

Arfi, N., & Agarwal, S. (2013). Figure 2f from: Irimia R, Gottschling M (2016) Taxonomic revision of Rochefortia Sw. (Ehretiaceae, Boraginales). Biodiversity Data Journal 4: E7720. https://doi.org/10.3897/BDJ.4.e7720. *International Journal of Scientific & Engineering Research, 4*(7), 2229–5518. doi:10.3897/bdj.4.e7720.figure2f

Brox, E., Fernandez-Luque, L., Evertsen, G., & González-Hernández, J. (2011). Exergames For Elderly: Social exergames to persuade seniors to increase physical activity. *Proceedings of the 5th International ICST Conference on Pervasive Computing Technologies for Healthcare. doi:10.4108/icst.pervasivehealth.2011.246049*

Campos, W., Martinez, A., Sanchez, W., Estrada, H., Castro-Sánchez, N. A., & Mujica, D. (2016). A systematic review of proposals for the social integration of elderly people using ambient intelligence and social networking sites. *Cognitive Computation, 8*(3), 529–542. doi:10.1007/s12559-016-9382-z

Chopik, W. J. (2016). The benefits of social technology use among older adults are mediated by reduced loneliness. *Cyberpsychology, Behavior, and Social Networking, 19*(9), 551–556. doi:10.1089/cyber.2016.0151

Davis, F., Bagozzi, R., & Warshaw, P. (1989). User acceptance of computer-technology - a comparison of 2 theoretical-models. *Management Science, 35*(8), 982–1003.

Depp, C. A., Schkade, D. A., Thompson, W. K., & Jeste, D. V. (2010). Age, affective experience, and television use. *American Journal of Preventive Medicine*, *39*(2), 173–178. https://doi.org/10.1016/j.amepre.2010.03.020.

Doleck, T., Bazelais, P., & Lemay, D. J. (2017). Need for self-expression on instagram: A technology acceptance perspective. Paper presented at the 1-3. doi:10.1109/CIACT.2017.7977305

Ekström, A., Ferm, U., & Samuelsson, C. (2017). Digital communication support and Alzheimer's disease. *Dementia*, *16*(6), 711–731. https://doi.org/10.1177/1471301215615456

Gorbis, M. (2015). Manna or Mammon in Silicon Valley? (2015, July 22). Retrieved from https://www.nytimes.com/roomfordebate/2015/07/22/is-silicon-valley-saving-the-world-or-just-making-money/innovation-is-happening-faster-than-we-can-adapt

Hargittai, E., & Dobransky, K. (2017). Old dogs, new clicks: Digital inequality in skills and uses among older adults. *Canadian Journal of Communication, 42*(2). doi:10.22230/cjc.2017v42n2a3176

Holden, R. J., & Karsh, B. (2010). The technology acceptance model: Its past and its future in health care. *Journal of Biomedical Informatics, 43*(1), 159–172. doi:10.1016/j.jbi.2009.07.002

Hung, M., Chang, I., & Hwang, H. (2011). Exploring academic teachers' continuance toward the web-based learning system: The role of causal attributions. *Computers & Education, 57*(2), 1530–1543. doi:10.1016/j.compedu.2011.02.001

Hwang, H. S., & Cho, J. (2018). Why Instagram? Intention to continue using Instagram among Korean college students. *Social Behavior and Personality: An International Journal, 46*(8), 1305–1315. doi:10.2224/sbp.6961

Iancu, I., & Iancu, B. (2017). Elderly in the digital era. Theoretical perspectives on assistive technologies. *Technologies, 5*(3), 1–13. doi:10.3390/technologies5030060

Iqbal, S., Ahsan, K., Hussain, M. A., & Nadeem, A. (2016). Social media as assistive technology for elderly. *Journal of Basic & Applied Sciences*, *12*.

Kane, David. "Security Awareness Training of the Elderly: Means, Methods, Discovery, Safety, and Security." Order No. 1605878 Utica College, 2015. Ann Arbor: *ProQuest.* Web. 3 Oct. 2018.

Lemay, D. J., Doleck, T., & Bazelais, P. (2017). "Passion and concern for privacy" as factors affecting snapchat use: A situated perspective on technology acceptance. *Computers in Human Behavior, 75*, 264–271. doi:10.1016/j.chb.2017.05.022

Lin, S., & Chou, W. H. (2011). Bridging the Social Media Usage Gap from Old to New: An Elderly Media Interpersonal and Social Research in Taiwan. *Human Centered Design Lecture Notes in Computer Science,* 547–555. doi:10.1007/978-3-642-21753-1_61

Lüders, M., & Brandtzæg, P. B. (2017). 'My children tell me it's so simple': A mixed-methods approach to understand older non-users' perceptions of social networking sites. *New Media & Society*, *19*(2), 181–198. doi:10.1177/1461444814554064

McCausland, L., & Falk, N. L., (2012). From dinner table to digital tablet: Technology's potential for reducing loneliness in older adults. *Journal of Psychosocial Nursing & Mental Health Services, 50*(5), 22-–26. doi:http://dx.doi.org/10.3928/02793695-20120410-01

National Center for Health Statistics. (2018, December 05). Retrieved from https://www.cdc.gov/nchs/

Niehaves, B., & Plattfaut, R. (2014). Internet adoption by the elderly: Employing IS technology acceptance theories for understanding the age-related digital divide. *European Journal of Information Systems, 23*(6), 708–726. doi:10.1057/ejis.2013.19

Olsson, T., Samuelsson, U., & Viscovi, D. (2018). Resources and repertoires: Elderly online practices. *European Journal of Communication, 34*(1), 38–56. doi:10.1177/0267323118810852

Parida, V., Mostaghel, R., & Oghazi, P. (2016). Factors for elderly use of social media for health-related activities. *Psychology & Marketing*, *33*(12), 1134–1141. doi: 10.1002/mar.20949

Schreurs, K., Quan-Haase, A., & Martin, K. (2017). Problematizing the digital literacy paradox in the context of older adults' ICT use: Aging, media discourse, and self-determination. *Canadian Journal of Communication*, *42*(2).

Subagdja, B., & Tan, A. (2015). Coordinated Persuasion with Dynamic Group Formation for Collaborative Elderly Care. *2015 IEEE/WIC/ACM International Conference on Web Intelligence and Intelligent Agent Technology (WI-IAT),* 352–359. doi:10.1109/wi-iat.2015.77

Tak, S. H., Beck, C., & McMahon, E. (2007). Computer and internet access for long-term care residents - perceived benefits and barriers. *Journal of Gerontological Nursing, 33*(5), 32–40.

Tsai, T.-H., Chang, H.-T., & Ho, Y.-L. (2016). Perceptions of a specific family communication application among grandparents and grandchildren: An extension of the technology acceptance model. *Plos One*, *11*(6). doi: 10.1371/journal.pone.0156680

World Population Prospects - Population Division. (n.d.). Retrieved from https://population.un.org/wpp/

Yu, R. P., Ellison, N. B., & Lampe, C. (2018). Facebook use and its role in shaping access to social benefits among older adults. *Journal of Broadcasting & Electronic Media, 62*(1), 71–90. doi:10.1080/08838151.2017.1402905

Zambianchi, M., Rönnlund, M., & Carelli, M.G. Attitudes towards and use of information and communication technologies (ICTs) among older adults in Italy and Sweden: The influence of cultural context, socio-demographic factors, and time perspective. *J Cross Cult Gerontol, 34***,** 291–306 (2019). https://doi.org/10.1007/s10823-019-09370-y

Zulkifli, A. N., Noor, N. M., Bakar, J. A., Mat, R. C., & Ahmad, M. (2013). A Conceptual Model of Interactive Persuasive Learning System for Elderly to Encourage Computer-Based Learning Process. *2013 International Conference on Informatics and Creative Multimedia*. doi:10.1109/icicm.2013.10