




JOURNAL OF RESILIENT ECONOMIES

PLATINUM OPEN ACCESS 

Journal homepage: <https://journals.jcu.edu.au/jre/index>



Variables Influencing Older Adults' Intention to Use Home-Based Care Technologies: An exploratory study

Elsy Paola Garcia Reyes¹, Carmen Reaiche²

Abstract

The increase in the population of older adults is becoming a global urban problem due to increasing health and welfare needs. Innovations in home-based care technologies offer new approaches to delivering care, reducing costs, and supporting aging in place. However, it appears that there are various influencing factors in relation to the adoption and use of technologies by older adults. This research aims to explore the nature of these factors as well as to evaluate and understand if they influence how older adults approach the adoption of home-based care technologies. Addressing this question could help understand the acceptance and identify the education and training needs required for the use of modern technologies by older adults. To achieve this, we used the Unified Theory of Acceptance and Use of Technology (UTAUT) and adopted a qualitative approach. Findings identified some of the key factors influencing older adults' intention to use technologies, including perceived need, social network, self-efficacy, anxiety and attitude towards technology. These factors were not originally evaluated in the UTAUT model; these emerged from the interpretative approach taken on the concerns and perceptions noted by the older adults interviewed. This result provides evidence for the requirement to expand the standard UTAUT model previously used to understand technology adoptions. We argue that the University of the Third Age plays a critical role in enabling senior citizens' knowledge and therefore helping their intention to use these technologies.

Keywords: University of Third Age, Older Adults, UTAUT model, Innovation Technologies for the Senior, Factors

¹ Corresponding author: School of Computing and Information Systems, The University of Melbourne, Australia, ORCID 0000-0002-9411-1208, email: egarciareyes@student.unimelb.edu.au

² PhD, Associate Professor, College of Business, Law and Governance, James Cook University, Australia, ORCID 0000-0001-5628-7504, email: carmen.reaiche@jcu.edu.au

1. Introduction

According to the World Health Organization (WHO, 2013), individuals in the world population aged 60 or more will grow to 2 billion by 2050, with most of the increase in developing countries. They will outnumber children under the age of five by 2020 (refer to Figure 1). The aging population is a significant concern because authorities must be able to meet the demands of a large population of older adults with health and welfare needs. Innovations related to community and home-based care offer new approaches to delivering care while trying to bend the cost curve (old adults and government) and supporting aging in place.

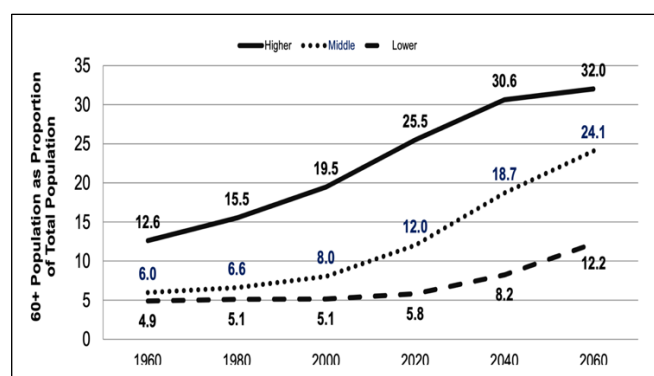


Figure 1. 60+ population as a proportion of the total population in low, middle and high-income countries (1960–2060) (WHO 2013)

These innovations focus on preventive care and health promotion (WHO, 2013). Exemplary innovations are a) home wireless blood pressure monitor, which works with an application to track and keep blood pressure measurements. It can monitor older adults' health from any location and share the data with a doctor, b) pendant alarm, which helps to communicate with a list of contacts when older adult requires attention. The alarm has an in-built mobile SIM that allows sending information to a call centre or a list of predetermined contacts, and c) companion robots that stimulate older adults to take part in digital and physical activities. They offer an easy interface to access services such as social media, messaging programs, and audio and video streaming. They can also help to remind older adults to take medications.

Therefore, home-based care benefits facilitate a) aging in place: older adults are not forced to go into some care facilities. The majority of older people want to 'age in place' (their homes) safely and for as long as possible (Vasunilashorn et al., 2012) rather than moving to a residential care institution (Yusif et al., 2016), b) prevent future illness: older adults might be able to maintain a good quality of life and extend their life expectancy healthfully, c) independence: these technologies lead to older adults being able to look after themselves, live on their own longer, and make their own decisions over their health and daily living (Sixsmith & Gutman, 2013; WHO, 2013). Lee and Coughlin (2015) argued that "older adults pursue independent, active and socially connected lifestyles, although they are stereotyped as weak, dependent and reluctant to change.", d) social isolation: technology offers opportunities for increased social connectivity, which can be beneficial for older adults who are

isolated, live alone, or are geographically distant from their family members, and e) potential cost savings.

However, there appears to be a gap in the literature as well as in practice around the existing issues preventing the adoption of these technologies for older adults. For some older adults, these types of technologies are difficult to master. Pan and Jordan-Marsh (2010) mentioned that "older people are more likely to consider how much effort they have to make in adopting new technology and leveraging the risks and benefits more carefully." Also, older adults accept technology based on certain factors, such as utility and cost (Lee & Coughlin, 2015).

Iwasaki (2013) found that older adults will use technology tools if the technology is affordable, available, and usable. Another issue, such as the level of human interaction, would be reduced by the introduction of technology (Sixsmith & Gutman, 2013). Furthermore, some factors associated with aging, such as physical and mental changes, memory loss, and decreased cognitive abilities, are challenges in the teaching-learning process of new technologies in older adults (Winstead et al., 2013; Martínez-Alcalá et al., 2018; Czaja, 2013). It is here that The University of the Third Age plays an important role. The University of the Third Age (U3A) is a worldwide organisation that aims to provide educational opportunities to anyone over retirement age in a supportive environment (The U3A Movement, 2022). Not only in enabling education to the old adults but also in encouraging a feeling of self-confidence and trust in their own capabilities to continue to live independently with the aid of these new technologies.

Given these challenges, the research problem that we aimed to address in this study is focused on: What factors influence older adults' intention to adopt home-based care technologies? and Does the University of the Third Age have a facilitator role in the adoption of these technologies?

To answer these questions, this study adopted the Unified Theory of Acceptance and Use of Technology (UTAUT) as the underpinning theoretical framework and followed a qualitative approach to explore how older adults perceive home-based care technologies relevant to their health care and identify factors that affect their use. Research findings identified some critical factors impacting the adoption of these technologies, including perceived personal need, social network, self-efficacy (i.e., capacity to learn and operate the technology), anxiety, attitude towards technology, as well as UTAUT constructs (refer to Figure 2) such as performance expectancy, effort expectancy and facilitating conditions (i.e., training).

The understanding of these factors could contribute to shaping future training – educational development materials for individuals, as well as contribute to guiding organisations in the development of aged care initiatives that involve home-based care technologies. Strategies can be developed to prevent, reduce or eliminate resistance to the adoption of these technologies and provide training if needed, tailored to the third age.

2. Methodology and Research Tool

2.1 Study Design

This research adopted a qualitative approach as it was considered the most appropriate to shed light on the "softer" side of the factors impacting older adults' technology adoption. A qualitative study helps to discover reasons for the perceptions that the observed older adult has towards technology, especially the reasons that are not evident and are considered invisible factors or surprising ones, such as feelings and emotions (Stephens et al., 2018). As the participants of the study were considered at a fragile age, the focus group approach was adopted. Focus groups were considered to be the perfect fit to address the nature of the participants but also, as it is a qualitative method that enables open discussions about participants' perceptions, opinions, beliefs and attitudes (Stephens et al., 2018). After concluding the focus group, the study was followed by a set of nine semi-structured interviews. The purpose of the focus group and individual interviews were to explore the influence of constructs of the UTAUT model and additional possible factors on older adults' intention to use home-based care technologies.

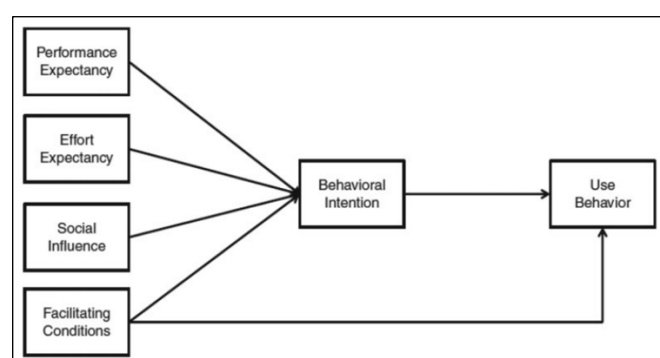


Figure 2. Unified Theory of Acceptance and Use of Technology (UTAUT) Model (Venkatesh et al. 2003)

2.2 Data Sample recruitment

This study received ethics approval No. H-2018-187 from the University of Adelaide's ethics committee. Once ethics approval was granted through the university, nine participants were recruited through a snowball sampling to conduct the semi-structured interviews. This process involved asking participants to mention the study to people they thought might be interested in participating. Another eleven participants who comprised the focus group were recruited in "On Statenborough" semi-retirement village in Adelaide, South Australia. The recruitment process took a volunteering approach. A recruitment flyer was placed in the retirement entry facility, in which volunteers signed up for the focus group. Participants' criteria were a) to be over 65 years old and b) to speak and read English.

2.3 Data Collection

Data was collected between a period of two months. Interviews were conducted in-person at a convenient time and place for the participants in the Adelaide city centre. The focus group was conducted on "On Statenborough" semi-retirement village located in Leabrook, Adelaide. These two forms of data collection were carried out with the help of two action researchers. During each interview, the researchers started with an introduction of the study, while

participants provided written consent. Next, examples of home-based care technologies such as pendant alarms, home wireless blood pressure monitors, and companion robots were discussed. Participants chose a device mentioned above or another device according to their health needs. Then, participants answered questions that followed the statements of the UTAUT constructs and their selected devices. Interviews were recorded and later transcribed with the use of verbatim. Demographic data was collected from participants, except for the focus group, who refused to do an interview and be recorded. However, participants of the focus group were able to answer open questions related to why they reject to use of technologies for healthy aging.

2.4 Participants

Six female and three male participants aged 60 to 89 years (see Table 1 and Table 2) participated in the interviews. Most of them reported living independently, and only one reported living with relatives. Five of them reported health issues such as hearing loss and falls. A total of eleven female participants aged 80-89 years participated in the focus group. Table 3 summarises interview respondents' demographics.

Table 1. Interview Participant's demographic information

Participants	Gender	Age	Highest level of education	Marital Status	Housing
Participant 1	Female	60-69 years	University or highest educational institution	Divorced	Other
Participant 2	Female	80-89 years	Secondary school	Widowed	Owned outright
Participant 3	Female	70-79 years	University or highest educational institution	Married	Owned outright
Participant 4	Female	70-79 years	University or highest educational institution	Married	Owned with a mortgage
Participant 5	Male	70-79 years	University or highest educational institution	Married	Owned with a mortgage
Participant 6	Male	80-89 years	University or highest educational institution	Divorced	Owned outright
Participant 7	Female	70-79 years	Secondary school	Divorced	Owned outright
Participant 8	Female	60-69 years	Technical or further educational institution	Married	Owned outright
Participant 9	Female	60-69 years	Technical or further educational institution	Married	Owned outright

Table 2. Selected device per participant

Participants	Selected device	Time use	Need for assistance or supervision	Reasons for assistance or supervision
Participant 1	Hearing aid	5 years	Yes, sometimes	Difficulty with hearing
Participant 2	Pendant alarm	Less than 4 years	Yes, sometimes	Old age
Participant 3	Pendant alarm	Not use	No	No need for help or supervision
Participant 4	Pendant alarm	Not use	No	No need for help or supervision
Participant 5	Implanted recorder	8 years	No	No need for help or supervision
Participant 6	Companion robot	Not use	No	No need for help or supervision
Participant 7	Companion robot	Not use	No	No need for help or supervision
Participant 8	Companion robot	Not use	No	No need for help or supervision
Participant 9	Companion robot	Not use	No	No need for help or supervision

Table 3. Focus group's demographic information

	Gender	Age	Income
Participants	Female	80-89 years	High
Total	11	11	11

2.5 Data Analysis

First, we used the Unified Theory of Acceptance and Use of Technology UTAUT theory (Venkatesh et al., 2003) in the interview questions by examining UTAUT constructs such as performance expectancy, effort expectancy, facilitating conditions and social influence, and other constructs such as self-efficacy, anxiety, and attitude towards technology. UTAUT model was developed to predict individual adoption and use of new information and communication technologies, and it was based on eight prominent user acceptance models (Venkatesh et al., 2003).

Also, the UTAUT model has been applied in various studies such as e-commerce, mobile devices, online services, and applications (Aggelidis & Chatzoglou, 2009; Anderson et al., 2006; Carlsson et al., 2006; Garfield, 2005; Gascho Rempel & Mellinger, 2015; Gruzd et al., 2012; Ifenthaler & Schweinbenz, 2013; Marchewka & Kostiwa, 2007; Pan & Jordan-Marsh, 2010; Park et al., 2007; Van Biljon & Renaud, 2008), in which have demonstrated that the UTAUT model provides a robust base to explain the variables that influence the adoption of technology. According to Venkatesh et al. (2003), UTAUT proposed four main factors that influence intention and use of information technology, such as

performance expectancy - "the degree to which an individual believes that using the system will help him or her to attain gains in job performance", effort expectancy - "the degree of ease associated with the use of the system", facilitating conditions - "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" and social influence - "the degree to which an individual perceives that important others believe he or she should use the new system". Behavioural intention to use is "an individual's motivation or willingness to use a system", and it is determined by the following factors: performance expectancy, effort expectancy, social influence and facilitating conditions. Venkatesh et al. (2003) also examined three other constructs, such as anxiety, self-efficacy, and attitude toward using technology, which found them not to have a direct effect on the behavioural intention to use. Therefore, they were dropped by Venkatesh et al. (2003) study.

However, there are studies related to factors and barriers associated to technology adoption by older adults, which showed these constructs previously mentioned do in fact, affect older adults' use of technologies (Andrews et al., 2019; Chiu & Liu, 2017; Czaja et al., 2006; Mitzner et al., 2010; Navabi et al., 2016; Vaportzis et al., 2017; Wild et al., 2012). These studies did not use UTAUT model in their data analysis. For this reason, these three constructs are included in this study.

In addition to the four main factors, the UTAUT model includes four variables such as age, gender, experience and voluntariness of use, which may increase or decrease the influence of the four main factors on the dependent variables' intention and use behaviour. Due to the small sample of the population in this study, it was not possible to make comparisons through the demographic and individual characteristics of the sample, such as age or gender. Therefore, this study excluded the exploration of these moderating factors. Interviews transcripts were thematically analysed, and the coding was completed using a qualitative data analysis tool, NVivo12 (Jackson & Bazeley, 2019). Finally, we employed UTAUT constructs over the categories that emerged from the thematic analysis of the transcripts.

This interview data analysis allowed to identify and explore unknown aspects and critical factors of technology acceptance beyond the TAUT model and consequently indicated significant additional factors to older adults' intention to use home-based care technologies.

3. Findings

Two categories emerged during the thematic analysis, mainly: a) perceived need and b) social network, both influencing the use of home-based care technologies. Figure 3 shows a summary of the emergent factors. Also, factors such as self-efficacy, anxiety, and attitude towards technology, as well as the UTAUT constructs such as performance expectancy, effort expectancy and facilitating conditions, were found relevant in the technology acceptance by older adults.

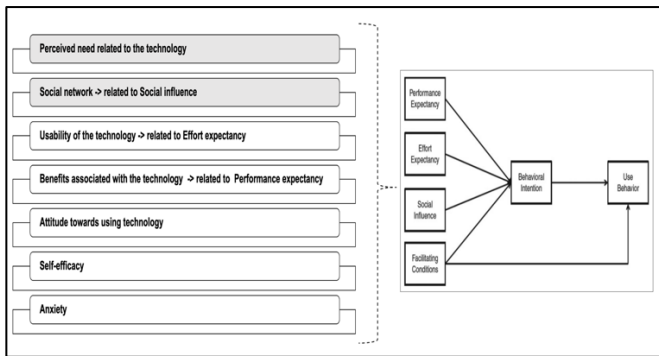


Figure 3. Emergent Factors integration with Unified Theory of Acceptance and Use of Technology (UTAUT) Model

3.1 Identified Factors influencing the use of technologies

3.1.1 Perceived need related to the technology

Perceived need is a category not included in the UTAUT model and, which emerged during the data analysis. In this study, the *perceived need* was the most frequent factor reported by the majority of the participants (mentioned by 78% of the participants). In addition, participants related a stage in which they would need support of the technology permanently; in order to use it. Cohen-Mansfield and Frank (2008) defined that "perceived need refers to an individual's own judgment about the necessity or benefits of a particular service". Here is an example of how one participant, who is in good health, explained it:

"For the pendant, you know, you can have a stroke or a heart attack or something tomorrow, and you might need to use it, you know. But at the moment I don't plan to. I would use it when I need it (participant 7)."

Also, another participant who has current mobility problems with their legs said:

"I only walk if I have the pendant alarm with me (participant 2)."

These findings suggested the use of technology is related to older adults' current health needs. If they think that they do not need it, they do not see the use of the technology. Based on our sample, *perceived need* strongly indicates to influence the intention and use of home-based care technologies.

3.1.2 Benefits associated with the technology

In the UTAUT model, performance expectancy (PU) is defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003). The original statements of UTAUT model were adjusted and related to the health management. For example 1. I would find this technology useful in my health management. 2. Using this technology to maintain my health would enable me to accomplish my daily activities more quickly. 3. Using this technology would increase my ability to maintain my health. 4. If I use the system, I will increase my chances of improving my health.

On the theme of performance expectancy, we asked these questions relating the selected device by the participants and, we inductively analysed their responses to the questions to identify which categories the participants associate them. Based upon the data analysis, the most relevant categories to the statements that under-pin this construct were related to benefits associated with the use of technologies. The main benefit identified was helping with older adults' health issues (mentioned by 56% of the participants). Some of the participants expected the device to help with their health issues or related consequences of aging. For example, participant 8, who was in good health and did not need assistance, indicated that:

"[It[technology]], would help me to take my medicine, helps to remember my things, then for sure it will be my companion".

Some of the participants reflected to various situations that caused struggles with their health and how the selected device could help them. For example, participant 6 commented:

"With age comes worries, I worry and get anxious. In terms of anxiety, if I find that at the end of the day, I have missed some phone calls. I worry, then I get anxious and I don't sleep. I tend to worry about things that I never use to worry about before ... even the good things. Because I don't hear the phone, I don't know what is happening, I don't know who's called me. These are the reasons why I choose the robot ... because it can speak louder".

Another benefit raised by some of the participants (44% of the participants), was providing safety in times of emergency or companionship in times of loneliness. For example, participant 2, who uses a pendant alarm and lives alone mentioned that:

"I think that the device helps me because someone can come quickly to my house when I press the device. I know I can get help if I use it. you know, which I have done."

Tracking health management was another benefit expected by participants. Participant 1 mentioned that she would bring to her medical appointments a summary of her health with the help of these technologies. Also, they could suggest changes, according to their needs, in their routines. Participant 5, who is using an implanted recorder that allows continuous cardiac monitoring, said:

"Activities related to managing and keeping my health includes seeing a professional. One of these activities would be to see somebody about changing my track routine. I see that there is an activity I could propose if I knew that I need".

Finally, participating in social activities was raised by participants in the study. This benefit of the use of these technologies is an expectation and affirmation of the participants. It was manifested by participant 7:

"Because I can see how it would be an advantage [using the technology] that in some way if I forget to take a medication there is a way to remind me. I think it would be good and worthwhile spending time to learn how to use it."

Also, participant 1, who has been using a hearing aid, mentioned that:

"I can attend more social activities [using the technology]".

However, related to the second question of the performance expectancy construct, some of the participants disagreed that these technologies could help to do more quickly their activities related to maintaining their health (3 participants), as summarised by the following quote from the interviews: Participant 4 commented that:

"No, I don't think it would change anything about the activities I do to keep me in good health, it doesn't make any difference."

Based on these observations, older adults expect that the use of these technologies are beneficial to their health, but they could not perceive that they can improve their activities related to health management. Also, there are benefits mentioned beyond the health context, such as the safety feeling of engagement while participating in social activities. Overall, these mentioned benefits will have a positive influence on the intention to use home-based care technologies. Consequently, performance expectancy will be positively associated with older adults' intention to use home-based care technologies and willingness to seek training.

3.1.3 Usability of the technology

According to Venkatesh et al. (2003), effort expectancy is "the degree of ease associated with the use of the system". This UTAUT construct is characterised by the following statements: 1. My interaction with this technology would be clear and understandable. 2. It would be easy for me to become skilful at using this technology 3. I would find this technology easy to use. 4. Learning to operate this technology is easy for me.

These statements were related to the easy or difficult use of the selected technology by the participants. We asked these questions, analysed inductively participants' responses, and identified categories linked to them. The most relevant category was related to the technology design associated with the use of the selected technology. The majority of the participants in the study manifested that home-based care technologies would be designed to be easy to interact with and use. However, the possibility of studying and training on this technology was required and, to a certain degree, made them think twice before considering engaging with the technology. For example, participant 9, who chose a companion robot to answer the interview, stated:

"I think this [companion robot] is designed to be easy to use or easy to learn how to use it."

Also, some of them expect that these technologies would be similar to use, and the settings are as similar as other technologies that are familiar to them. Participant 8 mentioned that it will be easy for her to learn to operate the companion robot if the companion robot is like using her mobile phone. However, some of the participants (approximately 22% of the overall participants) raised

concerns regarding the difficulties of learning how to use these new technologies. These participants chose a companion robot as the selected device to answer the interview. As expressed by participant 7:

"It's very difficult to learn new technology. I need some specific guidance or training to show me how, but if I get training, then I get it, and I am all right, but I know it takes longer and I may not know where to seek this training. Well, it's what it is."

A key finding was that 100% of the participants showed a willingness to learn as it is described by the following quote:

"I need a good teacher... then I am happy to adopt a technology that helps in my health needs. If I had to do it, I would, I just don't know who to approach or where to go (participant 6)."

At this point, the pose the following question: Are you aware of The University of the Third Age? All participants, both, the ones in the focus groups as well as the interviewees, declare unawareness. However, they all agreed that they would need support or assistance to learn how to use new technologies. In sum, there are positive expectations by older adults related to the usability of the technologies, but there are some concerns related to learning new technologies. Thus, effort expectancy could have a positive association with the intention and use of these technologies.

3.1.4 Social network

Social influence, UTAUT construct is defined as "the degree to which an individual perceives how important others believe that he/she should use the new system" (Venkatesh et al., 2003). When measuring the social influence construct, Venkatesh et al. (2003) used statements such as: 1. People who influence my behaviour think that I should use this technology. 2. People who are important to me think I should use this technology. 3. The community around me has been helpful in the use of this technology. 4. In general, the community has supported the use of this technology. The first two statements of this construct evaluated if participants' important people would recommend using these technologies. The third and fourth statements, regarding the community that surrounds older adults, supported the use of selected technologies. Also, the participants mentioned the top three people who influenced their decision to use this technology in the interviews (Table 4). According to this sample, older adults' social contact was primarily with their close family (specifically partners, children and grandchildren), friends and doctors. These contacts provide them with advice and the support they could need. Participant 1 manifested that her family supports her when she needs help with her hearing aid. Also, participant 7 mentioned that:

"I think my daughter will think that I should use it [technology] because for my own safety".

Moreover, some of the participants (56% of the participants) reported that some organisations provide them devices at no cost and also encourage them to enrich their lives through their participation in social and sports activities, as well as training, that help their health management. Therefore, we expect that social networks could positively influence the use of technology among

older adults due to the provision, support (or informal training) and advice of technologies that could provide to them.

Table 4. Top three people with their initials who influence older adult's decision to use a technology

Participants	Top 1	Top 2	Top 3
Participant 1	E youngest daughter	A eldest daughter	S doctor
Participant 2	A son	P son	S daughter
Participant 3	R husband	S son	D granddaughter
Participant 4	S son	B doctor	M son
Participant 5	R wife	H doctor	B doctor
Participant 6	R son	E daughter	L ex-wife (friend)
Participant 7	D daughter	J doctor	K friend
Participant 8	O husband	M son	E daughter
Participant 9	P wife	M son	E daughter

3.1.5 Facilitating conditions

Venkatesh et al. (2003) mentioned that facilitating condition is "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system". This UTAUT construct is characterised by the following four statements: 1. I have the resources necessary to use this technology. 2. I have the knowledge necessary to use this technology. 3. This technology is not compatible with other technologies I use. 4. A specific person (or group) is available for assistance with technology difficulties. Its first three items covered here are sources and identifying the knowledge necessary to use these technologies, as well as the compatibility of these technologies with other technologies. The last item was associated with technical support. According to the inductive analysis of the data, we found that the majority of participants (78% of the participants) have the resources necessary to use the technology but may lack knowledge, as described by participant 3:

"I am able to put into place but not so sure of the ongoing operation."

Also, some of these participants receive support from organisations such as DVA (Department of Veterans' Affairs, which was mentioned in 3.1.4 item) and the government, as they subsidise or provide these technologies to them, still none of them were pointed to The University of the Third Age. Older adults expect to have the resources, support and knowledge necessary to use these technologies.

3.1.6 Attitude towards using technology

Attitude toward using technology is defined as "an individual's overall affective reaction to using a technology" (Venkatesh et al., 2003). To measure this construct, Venkatesh et al.

(2003) used statements such as: 1. Using this technology is a good idea. 2. This technology makes my daily activities more interesting. 3. Using this technology is fun. 4. I like to use this technology. The data analysis revealed that all the participants

considered using the technology a good idea. Some of these participants, who chose the pendant alarm, mentioned that they would use the technology when they are in an emergency (it was mentioned in section 3.1.2 benefits associated to the technology). According to this finding, it can be assumed that participants can see the benefits and usefulness of the technology. Also, we found that some of the participants (22% of the participants) are afraid of technology due to their past experiences with other technologies such as mobile phones or computers, which reminds them of the struggles on learning and using them. As participant 7 expressed:

"For new technologies, it is a little bit scary, I changed my phone, it was a pain and I had nowhere to go for training."

This particular finding suggests that the attitude towards technology learning could negatively influence in the use of home-based care technologies.

3.1.7 Self-efficacy

Self-efficacy is defined as "the extent to which an individual believes that one has the capability to perform a particular task" (Compeau & Higgins, 1995; Venkatesh et al., 2000). This construct is characterised by the following four statements (Venkatesh et al., 2003): 1. I could complete the activities related to maintaining my health using this technology if there was no one around to tell me what to do as I go. 2. I could complete the activities related to maintaining my health using this technology if I could call someone for help if I got stuck. 3. I could complete the activities related to maintaining my health using this technology if I had a lot of time to complete activities for which this technology was provided. 4. I could complete the activities related to maintaining my health using this technology if I had just the built-in help facility for assistance. Based on the inductively analysed sample, some of the participants felt confident about using the technology after they learned it. So, the key finding here is the highlight to increase learning capabilities to increase older adult confidence. As participant 7 stated:

"Once I learn, it will be all ok."

Findings showed that if older adults feel confident, they will find it easy to use the technology. Therefore, if they have the assistance or the technical support required, they would more likely use the technology. Overall, in this study, self-efficacy is positively associated with intention to use these technologies. Again, an attribute reinforced by training and education development packages targeted to the third-age population.

3.1.8 Anxiety

Anxiety is defined as "an individual's apprehension, or even fear when the individual is faced with the possibility of using a system" (Venkatesh, 2000). To measure this construct, Venkatesh et al. (2003) used statements such as 1. I feel apprehensive about using this technology. 2. It scares me to think that I could lose a lot of information using this technology by hitting the wrong button. 3. I hesitate to use this technology for fear of making mistakes I cannot correct. 4. This technology is somewhat intimidating to me. After we analysed the data inductively, we found that the majority of participants demonstrated a low level of anxiety towards using technologies; however, some of the participants (22% of the participants) showed to be afraid of the use of these technologies, indicating that they felt fear of making mistakes or learning. Participant 7 mentioned:

"Scares me to learn a lot of things and especially if I don't even know how to approach learning."

Based on these findings, we can deduce that lower anxiety will have a positive effect on the use of technology. Thus, lower anxiety with clear training directions could cause a higher use of technology in older adults.

3.1.9 Intention to use

This UTAUT construct is defined as the older adults' intention to use technologies in the future, whether or not the older adult is currently using them. Intention to use has a significant favourable influence on technology usage. According to Venkatesh et al. (2003), this construct is characterised by the following statements: 1. I intend to use this technology in the next six months. 2. I predict I will use this technology in the next six months. 3. I plan to use this technology in the next six months. We asked these questions and analysed inductively participants' responses. We found that some of the participants (44% of the responses) who disagreed with intending to use the technology reported that they do not need the technology; however, they are aware that they could use it, if needed, in the future. These participants did not perceive a need to use the technology at present.

All participants of the focus group showed a negative attitude towards technology, and they refused to use these technologies. They reported the following: If they are in the stage that needs support, they will prefer to go to nursing homes due to the human interaction and support that they find there. They think technologies are invasive and training is only designed for young people. They do not use sophisticated mobile phones (they use simple mobile phones). They refuse to use devices that tell them what they must do as they relate their use to how old they are and a sign of aging. However, a critical finding that contradicts their responses was that almost all the focus group participants drive modern cars with GPS and semi-autonomous systems (the oldest cars were three years ago). They said that it took some time to learn and to get used to them. But, as they rely on the car, they have to find ways to learn as the car takes them to wherever they want to go. Cars provide them with more independence. Moreover, they thought that they did not need training in technology.

If they need to know something about how to use technology, they can watch videos on the internet. According to the focus group, it was found that older adults have some perceptions about technology that could explain the slow use of various technologies. Lack of human interaction, lack of support, invasiveness, difficulty in using technologies, lack of control, stereotypes or stigma of aging and lack of independence are perceptions that could be relevant barriers to the intention to use technologies.

4. Discussion

The UTAUT model was used to predict the use of technologies in a qualitative approach. According to the findings, we found factors such as perceived need and social networks that influence the intention to use technologies by older adults to be of great importance. Also, we confirmed the effect of UTAUT constructs on older adults' technology usage such as benefits associated to the technology (performance expectancy), usability (effort expectancy), and facilitating conditions. In addition, factors such as anxiety, self-efficacy and attitude towards technology, and factors that could affect the independence and identity of older adults, were found relevant in the adoption of technologies by older adults. Findings indicate that an older adult's health status or stage influences his/her perceived need and use of technologies, as we saw in section 3.1.1. Therefore, we conclude that "perceived need" is positively associated with the intention and use of home-based care technologies and agreement to seek training.

This finding was corroborated by a systematic review related to older adults' perceptions of fall prevention, detection or monitoring technologies (Hawley-Hague et al., 2014), which found that *perceived need*, in particular, is an influential factor in the acceptance of the technologies. Also, Peek et al. (2014) mentioned that some older adults would use technologies that support aging in place if they perceive a personal need for them. A study on older adults' perceptions of assistive technology (Demiris et al., 2008), mentioned that some older adults' willingness to adopt the technology resulted from their perceived need, which depended on their functional and physical status. Based on this sample, the perceived need was the most frequent factor mentioned in the intention to use technologies by older adults. Consequently, we can deduce that perceived need is an important factor in the use of home-based care technologies and a determinant for the acknowledgement of required training.

Based on this sample, performance expectancy was related to benefits associated with technologies, as we observed in section 3.1.2. We can suggest that performance expectancy has a positive influence on older adults' intention to use home-based care technologies due to the perceived benefits that are linked to the technology. This finding was confirmed by a study regarding older adults using computer technology, which confirmed that older people are more willing to adopt the technology in their daily lives as they find the direct benefit of the technology (White & Weatherall, 2000). Also, this finding was consistent with the theory of diffusion of innovations that manifests that older adults are less likely to use new technologies unless they see clear benefits of using them (Rogers, 1995).

The finding regarding safety supports the work of studies on older adults' perceptions of technologies for fall detection at home and emergency response systems (Brownsell & Hawley, 2004; Londei et al., 2009), in which participants used technologies because they felt it improved their safety. According to the findings, the usability of technology was related to effort expectancy, as we saw in section 3.1.3. We can imply that the usability of technology is positively associated with an older adult's intention to use home-based care technologies due to the expected easy design of these technologies. Hence, effort expectancy could have a positive association with the intention and use of these technologies. Some participants of this study mentioned difficulties in learning new technologies and consequently, older adults decide not to use these technologies. This finding could be related to the ability to learn in older adults is declining. Participants show a disposition to learn if they need the technology. This is a critical factor for The University of the third-age. Concerns about learning new technologies could change if support, and awareness of proper training of technologies are provided to older adults.

Regarding social influence, based on the sample, the majority of older adults' important people could influence the technology acceptance positively, as we observed in section 3.1.4. Participants mentioned that their close family (specifically partner, children and grandchildren), friends and doctors influence their decision to use technologies, and also, they suggest using them. These findings were also reported in a study about the role of family members in older adults' acceptance of technology (Luijckx et al., 2015), in which indicated that "older adults are willing to try to use tablets when their family and friends are convinced of its positive effects." Also, these authors commented that the enthusiasm and help of grandchildren are facilitators in the technology acceptance by older adults.

Moreover, these authors stated that many older adults' children would probably be promoted using certain technology when it helps to decrease their concerns. Other studies related to older adults' user experiences with mobile phones mentioned that friends and relatives, especially the opinion of children and grandchildren, impact the behaviour of the elderly mobile phone user (Lee, 2007). Moreover, older adults showed interest in using technology through the intervention of children. Additionally, participants of this study mentioned organisations that provide devices and encourage them to be involved in activities that help them in their health maintenance.

According to these findings, we identified a social network around the older adult (family, relatives, friends, children, organisations and health care providers) that introduce technologies and, provides support, information and advice related to technologies to older adults. Therefore, we expect that social networks could influence positively the use of technology among older adults due to the provision and assistance with technologies that could give to them. These social networks could also be the trigger for seeking further training. This finding supports the work of studies related to older adults' technology use and social support (Kamin et al., 2019; Peek et al., 2016), in which it was found that older adults' use of technology is associated with the provision of supportive behaviour from their social network. As for facilitating conditions, we

anticipate that this construct will have a positive effect on older adult's use of the technology as we observed in section 3.1.5. This is primarily related to the fact that many respondents reported that if they have support from organisations, enough resources, technical support, and the knowledge to use these technologies, they will correspond with the use of these technologies.

In this study, we also explored attitudes toward using technology, self-efficacy and anxiety, which were found non-significant factors by Venkatesh et al. (2003) in the UTAUT model. However, some studies (mentioned in section 2.5) discovered that these factors affect older adults' use of technology. Based on this sample, findings related to attitude towards technology showed that all the interviewees mentioned that technology is a "good idea" (as we saw in section 3.1.6). We can assume that participants have a positive attitude towards technology if they perceive the benefits of using technology. Therefore, older adults are more likely to use technology.

In accordance with this finding, a study on older adults' attitudes about technology showed that older adults adopt technologies if they perceive a positive result of using technologies and have the right avenues for training (Mitzner et al., 2010). In contrast, some of the participants of the study related to the use of new technologies to previous experiences of technologies as mobile phones or computers, which evoked difficulties in learning and using technologies. However, these participants showed a willingness to learn technology if they needed it. Also, they mentioned that technologies were not familiar with them and, were related to feeling in decline. Thus, we can deduce that the negative attitude towards technology is related to previous user experience with devices such as mobile phones or computers, not familiarity with technologies and, the stigma of aging in using technologies. If the attitude toward technology is negative, it is less likely the use of technology by older adults.

These findings corroborate the study related to older adults' barriers to the adoption of assistive technologies of Yusif et al. (2016) found that technologies focused on older adults are most frequently associated with negative attitudes towards technology due to the stigma and symbolism of their frailty, which technologies represent to them and, could prevent from using them. Also, these findings are supported by Walshand and Callan (2010), whose study was about older adults' perception and acceptance of technology in community-care settings, in which they mentioned that perception toward technology is founded on previous experiences. Brown and Venkatesh (2005), who tested a model of the adoption of technology in households, found that the introduction of new technology is referred other similar technologies to under-stand and decide the intention to use it.

According to self-efficacy, our findings showed that older adults would more likely use technology, if they find easy to use the technology, feel confidence after learning the technology, and receive technical support or assistance, as discussed in 3.1.7. Therefore, we assume that self-efficacy is positively associated with the intention to use these technologies. These findings appear to be consistent with Vaportzis et al. (2017), whose study in older adults' perceptions and barriers to interacting with tablets, mentioned that older adults would be more likely technology users, if they were more confident.

The focus group findings indicated that some older adults reject the use of new technology and mentioned barriers such as lack of human interaction, lack of support, invasiveness, usability, lack of control, stereotypes or stigma of aging and lack of independence. These participants highly value independence, social interactions, and not being perceived as fragile or weak individuals, and they demonstrated this with the use of modern cars, as we observed in section 3.1.9. We can assume that the lack of control and stereotypes or the stigma of aging and the need for training, referred to as barriers are related to independence.

5. Conclusion

The assessment and understanding of older adults' perceptions of home-based care technologies are essential in planning and predicting the future use of such technologies. In this study, a qualitative research design was chosen for the limited number of participants involved in this study. However, it was an effective way to investigate and explore factors that could influence older adults' intention to use home-based care technologies. As a theoretical framework, the Unified Theory of Acceptance and Use of Technology (UTAUT) theory was used. The model helps predicts individual adoption of technologies and therefore was used to develop the interview questions. Results showed that the acceptance of home-based care technologies is influenced by factors such as perceived need, social network and UTAUT constructs such as benefits associated with the technology (performance expectancy), usability (effort expectancy) and facilitating conditions.

In addition, self-efficacy, anxiety and attitude towards technology are important influencing factors impacting the intention to use technology. It is important to note that these factors are not included in the UTAUT model. With this study, we could perceive that perceived need has a strong influence and directly use of these technologies. If they perceive that they need the technology, they are willing to adopt it and seek training. Therefore, older adults' intention to use technology will be at some point in the future. Also, this late or slow adoption of the technology, it can be related to factors that affect the independence and identity of older adults, which are of highly valued to them. We concluded these perceptions through the importance of car ownership. An issue to explore and future research is to explore if these factors have a direct influence on the intention to use technologies and relatively could change: a) in the time and b) older adults are involved with more training. Also, future research could be done through a quantitative study, which allows for measuring the impact of these factors on the intention to use the technology. Moreover, other factors such as gender and experience with technology could be considered.

To summarise, factors identified and that emerged from this study were found relevant in this study and should be considered in the implementation of future projects and training programs directed to the Third Age. The study also suggests including these factors in the UTAUT model to expand understanding of the behaviour of technology engagement in the context of this study.

References

- Aggelidis, V. P., & Chatzoglou, P. D. (2009). Using a modified technology acceptance model in hospitals. *International Journal of Medical Informatics*, 78(2), 115-126. <https://doi:10.1016/j.ijmedinf.2008.06.006>
- Anderson, J. E., Schwager, P. H., & Kerns, R. L. (2006). The Drivers for Acceptance of Tablet PCs by Faculty in a College of Business. *Journal of Information Systems Education*, 17(4), 429-440. Retrieved from <http://proxy.library.adelaide.edu.au/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=23720689&site=ehost-live&scope=site>
- Andrews, J. A., Brown, L. J., Hawley, M. S., & Astell, A. J. (2019). Older Adults' Perspectives on Using Digital Technology to Maintain Good Mental Health: Interactive Group Study. *Journal of Medical Internet Research*, 21(2), e11694. <https://doi:10.2196/11694>
- Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension. *Management Information Systems Quarterly*, 29(3), 399-426.
- Brownsell, S., & Hawley, M. S. (2004). Automatic fall detectors and the fear of falling. *Journal Of Telemedicine And Telecare*, 10, 262-266. <https://doi:10.1258/1357633042026251>
- Carlsson, C., Carlsson, J., Hyvonen, K., Puhakainen, J., & Walden, P. (2006). *Adoption of Mobile Devices/Services - Searching for Answers with the UTAUT*. Paper presented at the Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS'06).
- Chiu, C. J., & Liu, C. W. (2017). Understanding Older Adult's Technology Adoption and Withdrawal for Elderly Care and Education: Mixed Method Analysis from National Survey. *Journal of Medical Internet Research*, 19(11), e374. <https://doi:10.2196/jmir.7401>
- Cohen-Mansfield, J., & Frank, J. (2008). Relationship Between Perceived Needs and Assessed Needs for Services in Community-Dwelling Older Persons.pdf. *The Gerontologist*, 48(4), 505-516. <https://doi:10.1093/geront/48.4.505>
- Compeau, D. R., & Higgins, C. A. (1995). Computer self-efficacy: Development of a Measure and Initial Test. *MIS Quarterly*, 19(2), 189-211. <https://doi:10.2307/249688>
- Czaja, S. J. (2013). Designing training and instructional programs for older adults / Sara J. Czaja, Joseph Sharit. In: CRC Press.
- Czaja, S. J., Charness, N., Fisk, A. D., Hertzog, C., Nair, S. N., Rogers, W. A., & Sharit, J. (2006). Factors Predicting the Use of Technology: Findings From the Center for Research and Education on Aging and Technology Enhancement (CREATE). *Psychology and aging*, 21(2), 333-352. <https://doi:10.1037/0882-7974.21.2.333>
- Garfield, M. J. (2005). Acceptance of Ubiquitous Computing. *Information Systems Management*, 22(4), 24-31. <https://doi:10.1201/1078.10580530/45520.22.4.20050901/90027.3>
- Gascho Rempel, H., & Mellinger, M. (2015). Bibliographic Management Tool Adoption and Use: A Qualitative Research Study Using the UTAUT Model. *Reference & User Services Quarterly*, 54(4), 43-53.
- Gruzd, A., Staves, K., & Wilk, A. (2012). Connected scholars: Examining the role of social media in research practices of faculty using the UTAUT model. *Computers in Human Behavior*, 28(6), 2340-2350. <https://doi:10.1016/j.chb.2012.07.004>
- Hawley-Hague, H., Boulton, E., Hall, A., Pfeiffer, K., & Todd, C. (2014). Older adults' perceptions of technologies aimed at falls prevention, detection or monitoring: a systematic review. *International Journal of Medical Informatics*, 83(6), 416-426. <https://doi:10.1016/j.ijmedinf.2014.03.002>
- Ifenthaler, D., & Schweinbenz, V. (2013). The acceptance of Tablet-PCs in classroom instruction: The teachers' perspectives. *Computers in Human Behavior*, 29(3), 525-534. <https://doi:10.1016/j.chb.2012.11.004>
- Iwasaki, N. (2013). Usability of ICT applications for elderly people in disaster reduction. *Journal of E-Governance*, 36, 73-78. <https://doi:10.3233/GOV-130338>
- Jackson, K., & Bazeley, P. (2019). *Qualitative data analysis with NVivo*: Sage.
- Kamin, S. T., Beyer, A., & Lang, F. R. (2019). Social support is associated with technology use in old age. *Z Gerontol Geriatr*. <https://doi:10.1007/s00391-019-01529-z>
- Lee, C., & Coughlin, J. F. (2015). PERSPECTIVE: Older Adults' Adoption of Technology: An Integrated Approach to Identifying Determinants and Barriers. *Journal of Product Innovation Management*, 32(5), 747-759. <https://doi:10.1111/jipim.12176>
- Lee, Y. S. (2007). *Older Adults' User Experiences With Mobile Phones: Identification Of User CLUSTERS AND USER REQUIREMENTS* (Doctor of Philosophy). Virginia Polytechnic Institute and State University, Faculty of the Virginia Polytechnic Institute and State University Retrieved from <https://vtechworks.lib.vt.edu/handle/10919/29003>
- Londei, S. T., Rousseau, J., Ducharme, F., St-Arnaud, A., Meunier, J., Saint-Arnaud, J., & Giroux, F. (2009). An intelligent videomonitoring system for fall detection at home: perceptions of elderly people. *Journal Of Telemedicine And Telecare*, 15(8), 383-390. <https://doi:10.1258/jtt.2009.090107>
- Luijckx, K., Peek, S., & Wouters, E. (2015). "Grandma, You Should Do It—It's Cool" Older Adults and the Role of Family Members in Their Acceptance of Technology. *International Journal of Environmental Research and Public Health*, 12(12), 15470-15485. <https://doi:10.3390/ijerph121214999>
- Marchewka, J. T., & Kostiwa, K. (2007). An Application of the UTAUT Model for Understanding Student Perceptions Using Course Management Software. *Communications of the IIMA*, 7(2). Retrieved from

<https://scholarworks.lib.csusb.edu/cgi/viewcontent.cgi?article=1038&context=ciima>

- Martínez-Alcalá, C. I., Rosales-Lagarde, A., Alonso-Lavernia, M. d. I. Á., Ramírez-Salvador, J. Á., Jiménez-Rodríguez, B., Cepeda-Rebollar, R. M., . . . Agis-Juárez, R. A. (2018). Digital Inclusion in Older Adults: A Comparison Between Face-to-Face and Blended Digital Literacy Workshops. *Frontiers in ICT*, 5. <https://doi:10.3389/fict.2018.00021>
- Mitzner, T. L., Boron, J. B., Fausset, C. B., Adams, A. E., Charness, N., Czaja, S. J., . . . Sharit, J. f. (2010). Older adults talk technology: Technology usage and attitudes. *Computers in Human Behavior*, 26(6), 1710–1721. <https://doi-org.ezp.lib.unimelb.edu.au/10.1016/j.chb.2010.06.020>
- Navabi, N., Ghaffari, F., & Jannat-Alipoor, Z. (2016). Older adults' attitudes and barriers toward the use of mobile phones. *Clin Interv Aging*, 11, 1371-1378. <https://doi:10.2147/CIA.S112893>
- Pan, S., & Jordan-Marsh, M. (2010). Internet use intention and adoption among Chinese older adults: From the expanded technology acceptance model perspective. *Computers in Human Behavior*, 26(5), 1111-1119. doi:10.1016/j.chb.2010.03.015
- Park, J., Yang, S., & Lehto, X. (2007). ADOPTION OF MOBILE TECHNOLOGIES FOR CHINESE CONSUMERS. *Journal of Electronic Commerce Research*, 8(3), 196-206. Retrieved from <http://search.proquest.com.ezp.lib.unimelb.edu.au/docview/236639894?accountid=12372>
- Peek, S. T., Luijkx, K. G., Rijnaard, M. D., Nieboer, M. E., van der Voort, C. S., Aarts, S., . . . Wouters, E. J. (2016). Older Adults' Reasons for Using Technology while Aging in Place. *Gerontology*, 62(2), 226-237. <https://doi:10.1159/000430949>
- Peek, S. T., Wouters, E. J., van Hoof, J., Luijkx, K. G., Boeije, H. R., & Vrijhoef, H. J. (2014). Factors influencing acceptance of technology for aging in place: a systematic review. *Int J Med Inform*, 83(4), 235-248. <https://doi:10.1016/j.ijmedinf.2014.01.004>
- Rogers, E. M. (1995). *Diffusion of Innovations*: New York : Free Press.
- Sixsmith, A., & Gutman, G. (2013). *Technologies for Active Aging* (Vol. 9): Springer US.
- Stephens, C., Burholt, V., & Keating, N. (2018). The SAGE Handbook of Qualitative Data Collection. In. <https://doi:10.4135/9781526416070>
- Van Biljon, J., & Renaud, K. (2008). A Qualitative Study of the Applicability of Technology Acceptance Models to Senior Mobile Phone Users. In *Advances in Conceptual Modeling – Challenges and Opportunities* (pp. 228-237).
- Vaportzis, E., Clausen, M. G., & Gow, A. J. (2017). Older Adults Perceptions of Technology and Barriers to Interacting with Tablet Computers: A Focus Group Study. *Frontiers in Psychology*, 8, 1687. <https://doi:10.3389/fpsyg.2017.01687>
- Vasunilashorn, S., Steinman, B. A., Liebig, P. S., & Pynoos, J. (2012). Aging in place: evolution of a research topic whose time has come. *Journal of Aging Research*, 2012, 6. <https://doi:10.1155/2012/120952>
- Venkatesh, V. (2000). Determinants of Perceived Ease of Use: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model. *Information Systems Research*, 11(4), 342-365.
- Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly*, 27(3), 425-478.
- Venkatesh, V. V., Morris, M. G., & Ackerman, P. L. (2000). A Longitudinal Field Investigation of Gender Differences in Individual Technology Adoption Decision-Making Processes. *Organisational Behavior and Human Decision Processes*, 83(1), 33-60. <https://doi:10.1006/obhd.2000.2896>
- Walsh, K., & Callan, A. (2010). Perceptions, Preferences, and Acceptance of Information and Communication Technologies in Older-Adult Community Care Settings in Ireland: A Case-Study and Ranked-Care Program Analysis. *Ageing International*, 36(1), 102-122. doi:10.1007/s12126-010-9075-y
- White, J., & Weatherall, A. (2000). A Grounded Theory Analysis of Older Adults and Information Technology. *EDUCATIONAL GERONTOLOGY*, 26(4), 371–386.
- WHO. (2013). *WHO Global Forum on Innovations for Ageing Populations*. Retrieved from http://www.who.int/kobe_centre/ageing/report/en/
- Wild, K. V., Mattek, N. C., Maxwell, S. A., Dodge, H. H., Jimison, H. B., & Kaye, J. A. (2012). Computer-related self-efficacy and anxiety in older adults with and without mild cognitive impairment. *Alzheimers & Dementia*, 8(6), 544-552. <https://doi:10.1016/j.jalz.2011.12.008>
- Winstead, V., Anderson, W. A., Yost, E. A., Cotten, S. R., Warr, A., & Berkowsky, R. W. (2013). You can teach an old dog new tricks: a qualitative analysis of how residents of senior living communities may use the web to overcome spatial and social barriers. *J Appl Gerontol*, 32(5), 540-560. <https://doi:10.1177/0733464811431824>
- Yusif, S., Soar, J., & Hafeez-Baig, A. (2016). Older people, assistive technologies, and the barriers to adoption: A systematic review. *International Journal of Medical Informatics*, 94(Supplement C), 112-116. <https://doi.org/10.1016/j.ijmedinf.2016.07.004>