University Library



A gateway to Melbourne's research publications

Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:
Thach, KS;Lederman, R;Waycott, J

Title:
Adoption of Videoconferencing for Social Connectedness among Older Adults: A Systematic Review

Date:
2021-01-01

Citation:
Thach, K. S., Lederman, R. & Waycott, J. (2021). Adoption of Videoconferencing for Social Connectedness among Older Adults: A Systematic Review. ACIS 2021 - Australasian Conference on Information Systems, Proceedings, ACIS.

Persistent Link:
https://hdl.handle.net/11343/354481

Adoption of Videoconferencing for Social Connectedness among Older Adults: A Systematic Review

Full research paper

Kong Saoane Thach
School of Computing and Information Systems
The University of Melbourne
Melbourne, Australia
Email: kthach@student.unimelb.edu.au

Reeva Lederman
School of Computing and Information Systems
The University of Melbourne
Melbourne, Australia
Email: reeva.lederman@unimelb.edu.au

Jenny Waycott
School of Computing and Information Systems
The University of Melbourne
Melbourne, Australia
Email: jwaycott@unimelb.edu.au

Abstract

Videoconferencing has been increasingly used for social connectedness in residential aged care (RAC). In sensitive settings such as RAC, it is important that technologies are introduced with careful consideration of people's needs and experiences with the technology, to ensure that the desired benefits are realised. This paper reviews research evidence about older adults using videoconferencing for social connectedness and issues raised by that use in order to identify strategies RAC providers can adopt to achieve a greater likelihood of sustainability. Fourteen articles were included for in-depth review. Devices featuring videoconferencing in the studies reviewed ranged from tablets to telepresence robots. Most study participants perceived videoconferencing as beneficial for social connectedness. The implementation of videoconferencing in RAC is impacted by differences in sociotechnical systems. This paper contributes key considerations for the future design and implementation of videoconferencing for social connectedness in RAC and opportunities for future work in this area.

Keywords: videoconferencing, sociotechnical systems, social connectedness, older adults, aged care.

1 Introduction

The aging population is growing worldwide (United Nations 2017). In Australia, around 15% of population were aged 65 and over (Australian Institute of Health and Welfare 2018). With advanced age, the risk of losing family members and social network members through illness and death increases. Therefore, the likelihood of loneliness and social isolation in this population has grown. Notably, due to the COVID-19 pandemic, feelings of social isolation and loneliness among aged care residents have risen (Wu 2020). Meanwhile, social support (e.g. family support and friends support) has been found to positively impact physical and mental well-being (Gong et al. 2020). Inadequate social support has been identified as a risk factor for depression in older adults (Bruce 2002; Chi et al. 2001). Thus, it is important to seek out strategies to assist older adults, especially those living in residential aged care facilities (RACFs), in maintaining social connectedness. One technology-based solution is the use of videoconferencing. The term videoconferencing in this study refers to a video-based computer-mediated communication with real-time audio-visual features allowing people to see, hear, and speak to each other remotely, regardless of the hardware and software being used. Examples of software offering videoconferencing are Zoom, Skype, WhatsApp. Devices that allow users to make videoconferencing might range from simple ones such as tablets/iPads or smartphones to more specialized ones tailored to different groups of people such as mobile remote-controlled telepresence robots.

Recently, RACFs, also known as residential aged care homes or nursing homes, which are complex environments involving residents with complex conditions and multi-co-morbidities (Dudman et al. 2018), have increasingly adopted videoconferencing for enhancing social connectedness among aged care residents. Videoconferencing is particularly appealing to residential care because it is a way for residents to communicate with loved ones who cannot visit because of geographical distance or other barriers, including COVID-19 restrictions. Also, videoconferencing has been found effective in enhancing social support and reducing social isolation in nursing home residents (Banbury et al. 2017; Beringer et al. 2013). As researchers have demonstrated, it is especially important that technologies are introduced carefully in sensitive settings as there can be significant ethical issues if technologies do not produce the desired benefits in such settings (Waycott et al. 2015). Meanwhile, technologies within organizations are, by nature, sociotechnical. That is, they influence, and are influenced by, the social setting in which they are used and need to be responsive to the usability issues of users (Rajanen et al. 2019). While older adults are the main group of users of this innovation, it is essential to synthesise research evidence about their experience with videoconferencing for social connectedness in order to inform the effective design and implementation of videoconferencing in RACFs in the future.

In this paper, we report findings from a systematic review that focused on synthesizing evidence from published studies that have investigated older adults' experiences of using videoconferencing for social connectedness. Although we ultimately aim to contribute to improved design and use of videoconferencing in RACFs, in this paper we draw on studies conducted with any groups of older adults – including those living in RACFs and those living in their own homes. Moreover, papers were not selected based on technological devices. That is, papers reporting studies with any devices featuring videoconferencing functions for social connectedness among older adults are included. In this review, we aim to answer three research questions: *(1) What kinds of videoconferencing should be designed for older adults living in RACFs? (2) How should videoconferencing be implemented in RACFs? and (3) What opportunities for information systems (IS) research in this topic emerge?* It is worth noting that there is a difference between people living in RACFs and people living independently in their own homes, in terms of their capacity to use technology. People who live in RACFs are likely to be frail, will often have dementia, and will typically need substantial support to take part in a video call. Older adults who live independently, in contrast, are likely to be more capable of using technology without, or with limited, support. Therefore, it is vital to acknowledge this difference in responding to these research questions. By undertaking this review, our paper makes three major contributions. Firstly, this paper critically reviews the existing evidence surrounding the use of videoconferencing for social connectedness in later life. The review enables us to investigate what is currently known about this topic and how much the use of videoconferencing within this context varies. Secondly, by extracting and thematically synthesizing relevant literature, different themes are revealed. Particularly, technological devices in the studies reviewed ranged from tablets to telepresence robots. Most study participants have positive attitudes towards videoconferencing. Videoconferencing brings benefits for older adults in terms of enhancing social connection and supporting visual communication. The adoption of videoconferencing among older adults is impacted by varied dimensions of sociotechnical systems (e.g. technology itself, its value, users' conditions/characteristics, organizational constraints, family involvements, and the adaptation of the technology to the environment). Finally, this review makes recommendations for the future design and implementation of videoconferencing in RACFs and opportunities for IS research in this topic.

2 Related work

Various kinds of technological interventions have been used for dealing with loneliness and social isolation among older adults, ranging from simple solutions, such as information communication technologies (ICTs) to connect with family and friends (Chen et al. 2016; Schuster et al. 2019), to more sophisticated programs, such as using virtual reality that let older adults 'travel' the world (Thach et al. 2020). In the literature, ICTs can refer to any forms of technologically-mediated communication (both asynchronous and synchronous communication) including texting, emailing, social media use, and videoconferencing. Chen et al. (2016) conducted a systematic review of twenty-five studies that examined the effect of ICTs on reducing social isolation among older adults. They included studies that employed varied kinds of ICT interventions such as emails, online chats, telehealth systems, video games, and visual pet companion apps (Chen et al. 2016). Thus, their review study would not specifically reflect the issues brought about by the use of videoconferencing. The review produced an inconclusive finding concerning the effect of videoconferencing on loneliness reduction among older adults. While Chen et al. (2016) took examined a range of ICTs for social connectedness, in the current review study, we focus solely on technology that offers videoconferencing features.

In terms of technology offering videoconferencing, Schuster et al. (2019) conducted a scoping review on the use of video communication with cognitively intact nursing home residents. However, since their review specifically limited its scope to studying cognitively intact residents only and limited searching to publications in PubMed, AgeLine, CINAHL, and PsycINFO databases, the review included only five articles. Among those included for in-depth review, three papers were from the same groups of authors. This potentially inhibited reflections from different perspectives and different disciplines. On the other hand, the present systematic review distinguishes from the review of Schuster et al. (2019) by including publications in other databases such as ACM Digital Library, IEEE Xplore, Web of Science, Scopus, Compendex, and Inspec. Because the topic in this review is interdisciplinary, relevant studies are likely to be published and indexed in a range of databases. Furthermore, as the aim of this study is to investigate existing research evidence on older adults' experiences of using videoconferencing for social connectedness, we do not limit the inclusion criteria to the studies conducted with cognitively intact aged care residents. That means we include studies conducted with older adults with various conditions. Synthesising research evidence about older adults' holistic experiences can provide insight from a sociotechnical perspective on the usability issues raised by older users. This insight is critical for aged care providers in developing technology-based person-centered care services for social connectedness.

While the review by Chen et al. (2016) studies ICT interventions in general and the review by Schuster et al. (2019) studies video communication specifically, neither review study focused on the variety of technological interventions offering videoconferencing. One technology not considered by these reviews is telepresence robots. Research on mobile telepresence systems designed for enhancing social interaction was narratively reviewed by Kristoffersson et al. (2013). However, this narrative review explored the use of telepresence robots across all ages, rather than older adults. On the other hand, research on the feasibility of using telepresence robots to enhance social connectedness among older adults, particularly living with dementia was integratively reviewed by Moyle et al. (2017). In this integrative review, Moyle et al. (2017) identified and conducted in-depth review on four eligible peer-reviewed publications searched from different disciplinary databases (e.g. Medline, ProQuest, PubMed, Scopus, Web of Science, CINAHL, EMBASE, and the Cochrane library). However, of the four publications included for in-depth review, three papers were more focused on other features of socially assitive robots rather than on videoconferencing system for facilitating social communication between older adults and others, which is out of the topic of this study. Only the paper written by Moyle et al. (2014) was focused on the telepresence videoconferencing system. However, only one paper would be inadequate to draw conclusions. Hence, a more in-depth systematic review focused on older adults' experiences with different kinds of technology featuring videoconferencing needs to be conducted. The study presented in this paper, therefore, aims to address this gap.

3 Methods

3.1 Search strategies

The literature search was undertaken in May 2021. Seven electronic databases were searched (ACM Digital Library, Compendex, IEEE Xplore, Inspec, PubMed, Scopus, and Web of Science). The search terms consisted of the following keywords and logical operations: (seniors OR elder OR ageing OR aging OR "aged care" OR elderly OR "older adult" OR "older people") AND (video OR videoconferencing) AND

(technology OR digital) AND (communication OR communicative). The search terms were applied for the article titles or abstracts. The search were restricted to publications written in English from 2010.

3.2 Study selection

The study selection for this review was conducted in a 4-step process following the PRISMA 2009 flow diagram (Moher et al. 2009). Firstly, databases were searched electronically for search terms. The initial search of included databases at this step yielded 1646 articles. Table 1 presents the details of results. A snowballing method, which was applied by checking papers that had been cited in the articles reviewed, was employed to identify additional relevant articles. The articles identified through snowballing method are not restricted to any published year. This would help us to identify any relevant publications that were published before 2010 which were not applied in our search strategies. Secondly, the title and abstract of those articles were screened to determine whether the paper focuses on older adults' experiences with using videoconferencing for social connectedness. In other words, studies that used videoconferencing features for telehealth purposes, such as detecting, treating, or rehabilitating from any health-related conditions, were not included. Thirdly, full texts of the remaining papers were assessed for eligibility of inclusion. This step did not exclude papers based on the technological devices being used in the study. If the technology featured videoconferencing functions, the paper would be included. This inclusion enables us to investigate how videoconferencing interventions varied. Finally, relevant data in included papers were extracted for review purposes. Figure 1 illustrates the process of article selection for this systematic review.

Research database	Results
ACM Digital Library	66
Compendex	455
IEEE Xplore	55
Inspec	155
PubMed	36
Scopus	215
Web of Science	664
Total of records	1646

Table 1. Results from the search

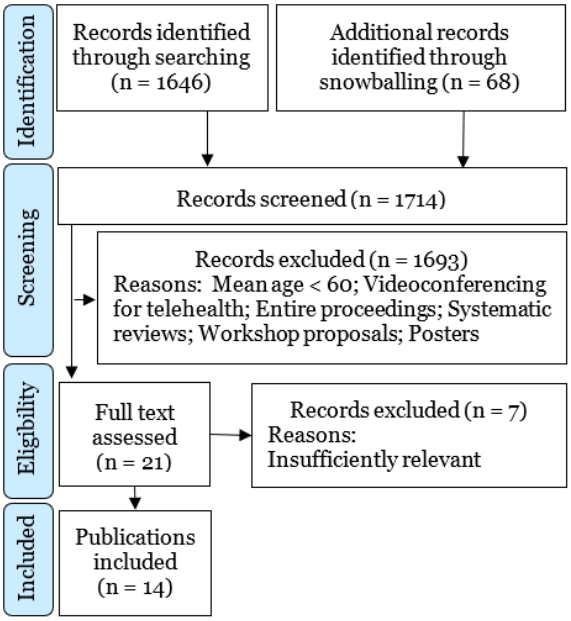


Figure 1. Flow diagram for study selection

As illustrated in Figure 1, a number of articles were excluded based on several reasons. For instance, articles that did not study older adults (mean age less than 60-years old) were excluded. Also, a range of papers that were from studies investigating the use of videoconferencing for telehealth were eliminated. We also excluded records that were the entire proceedings of a conference. That is, some of the database searches returned entire proceedings containing relevant individual papers. Thus, we decided to include the individual papers while excluding the entire proceedings. Other exclusion criteria were records that comprised systematic reviews of the literature, workshop proposals, and insufficiently relevant papers. At the completion of the screening step, one doctoral thesis (Zamir 2020) and fourteen papers were assessed for including in the in-depth review. However, since the thesis reported two of the fourteen articles assessed (Zamir et al. 2021; Zamir et al. 2018) and those two papers corresponded with two major chapters that have focused on studying videoconferencing within the thesis, we decided to include those two papers and exclude the thesis. At the completion of the selection process, fourteen research papers were included in this review (Banbury et al. 2017; Beringer et al. 2013; Boman et al. 2014a; Boman et al. 2014b; Hemberg et al. 2018; Moyle et al. 2014; Moyle et al. 2019; Moyle et al. 2020; Sacco et al. 2020; Seelye et al. 2012; Tsai et al. 2010a; Tsai et al. 2010b; Zamir et al. 2021; Zamir et al. 2018).

3.3 Data collection and analysis

This study primarily aims to synthesise research evidence about older adults' experiences with videoconferencing for social connectedness and relevant issues raised by that use in order to inform the future design and implementation of videoconferencing in RACFs. All data related to older adults' experiences with using videoconferencing for social connectedness were extracted. In this review, we do not conduct a meta-analysis since there is a large variability of study design and outcome measures adopted in the papers reviewed. Drawing on the data extracted, a thematic analysis on their findings was conducted. The findings of this analysis are presented below as primary outcomes of this review. The thematic analysis is coded based on similarities across the papers reviewed (Thomas et al. 2008).

4 Findings

Study characteristics of the included papers are summarized in Table 2. Through a thematic analysis of the findings from the studies reviewed, we identified some themes that will each be discussed below.

Paper	**Research samples** Number (N); Age (A); Living (L)	**Technology** Devices (D); Software: (S)
Banbury et al. (2017)	N: 45; A: mean of 73; L: their own homes	D: Tablets; S: N/A
Beringer et al. (2013)	N: 27; A: 60 – 95; L: their own homes	D: N/A; S: N/A
Boman et al. (2014a)	N: 4; A: 66 – 74; L: their own homes	Newly developed videophone
Boman et al. (2014b)	N: 5; A: mean of 63; L: their own homes	Preliminary design concept
Hemberg et al. (2018)	N: 7; A: ≥ 85; L: their own homes	Newly developed videophone
Moyle et al. (2014)	N: 5; A: 79 – 89; L: RACFs	Telepresence robot (Giraff)
Moyle et al. (2019)	N: 5; A: 69 – 87; L: their own homes	Telepresence robot (Giraff)
Moyle et al. (2020)	N: 6; A: 75 – 97; L: RACF	D: iPads; S: Skype
Sacco et al. (2020)	N: 132; A: 66 – 103; L: RACFs or hospital	D: N/A; S: N/A
Seelye et al. (2012)	N: 8; A: 64 – 92; L: their own homes	Mobile remotely controlled robot
Tsai et al. (2010a)	N: 34; A: 60 – 95; L: RACFs	D: N/A; S: N/A
Tsai et al. (2010b)	N: 57; A: mean of 74.42; L: RACFs	D: laptops; S: MSN/ Skype
Zamir et al. (2021)	N: 28; A: 65 – 97; L: RACFs	A 'Skype on Wheels' device
Zamir et al. (2018)	N: 8; A: ≥ 65; L: RACFs or hospital	A 'Skype on Wheels' device

Table 2. Summary of studies reviewed

4.1 Different technological devices

Among included papers, one did not directly conduct research with videoconferencing technology. Instead, the research team asked participants to watch a film showing the system offering videoconferencing and then to provide their views on the technology (Beringer et al. 2013). One paper did not specify devices and software/apps that were used for video communication (Sacco et al. 2020). Other reviewed research studied different devices that offer video-calls. Boman and colleagues studied a kind of videophone, which was newly developed specifically for older adults to connect with significant others such as their family and friends, from the design phase to the mock-up version (Boman et al. 2014a; Boman et al. 2014b). The videophone in their research included a touch screen, a camera on the top of the screen, a support holder to keep it standing, and a handset. Similarly, Hemberg et al. (2018) studied a device specially developed for older adults which includes a touch screen with camera, and 1 or 2 buttons enabling older adults to contact and interact with others. Also, Zamir and colleagues studied a mobile device called "Skype on Wheels" (SoW) comprising an iPad to make video-calls with their family using Skype, and telephone handset placed on a wheelable 'chassis' (Zamir et al. 2021; Zamir et al. 2018). Meanwhile, Moyle and colleagues examined a human-height, wheel-based, mobile telepresence robot with a videoconferencing system, called Giraff, enabling distant family to drive/move it around, view their older relatives, and initiate a video call with them (Moyle et al. 2014; Moyle et al. 2019). A mobile remote controlled robot used to communicate with family and friends among older adults was also studied in the research by Seelye et al. (2012). In another included paper, Moyle et al. (2020) examined a tablet (iPads) with Skype to explore the feasibility of using videoconferencing among

older adults living in RACFs. Tablets were also studied by Banbury et al. (2017) in conducting weekly group meetings to older adults living in regional areas, providing them an opportunity to connect with others in similar circumstances; however, they did not specify the software that was studied in the paper. Skype was also studied by Tsai and colleagues; however, the devices that they studied are large laptops (Tsai et al. 2010a; Tsai et al. 2010b).

4.2 Benefits of videoconferencing

Although different technological devices offering videoconferencing were studied, most included papers revealed the key benefits of videoconferencing on enhancing older adults' social connection and supporting visual communication. Regarding enhancing social connection, Tsai et al. (2010a) reported that compared to a control group receiving regular care only, significantly higher levels of social connectedness and reduced depressive and loneliness scores were reported in the intervention group with the use of videoconferencing to interact with their family five minutes per week for three months. These benefits were also found in other research (Beringer et al. 2013; Hemberg et al. 2018; Tsai et al. 2010b). The reduced stress and anxiety were also perceived by others with whom older adults communicated (Boman et al. 2014b). The satisfaction degrees of nursing home residents in the study by Sacco et al. (2020) were greater with video calls when there was assistance to establish communication during the COVID-19 confinement period. The perceived benefits of videoconferencing would be highlighted in the case that older adults' family are living overseas or not living in the same town with them (Beringer et al. 2013; Tsai et al. 2010b; Zamir et al. 2018). Particularly, study participants expressed desires to use videoconferencing to see or reconnect with some of their distant family whom they have not had chances to see (Zamir et al. 2018).

In terms of supporting visual communication, videoconferencing was used as a conversation provoker as they can see each other. According to the study participants, being able to see each other made it easier to find topics for conversation (Boman et al. 2014a; Boman et al. 2014b). Being able to see the family members' face was also noted as an important aspect of maintaining aged care residents' connections with their family. This is because residents, particularly those living with dementia, often forgot who they were talking to without seeing them (Moyle et al. 2014). Moreover, videoconferencing can help people with dementia to demonstrate their ideas and understand what is said in a conversation with signs, facial expressions, and body language (Boman et al. 2014b; Moyle et al. 2019; Zamir et al. 2018). Videoconferencing might also help to improve quality of conversation as the residents would 'feel' like they were talking to the caller in-person and be 'more in contact with them' (Moyle et al. 2020). Furthermore, in the videoconference interactions, they could have fun with their family, for example, being entertained, sharing in-time events and looking at family photos (Tsai et al. 2010b). Moreover, by being able to see each other, videoconferencing was also used as a tool to reassure a person's health and well-being from either older adults' side or the side of people whom they were communicating with (Beringer et al. 2013; Boman et al. 2014b; Moyle et al. 2014; Tsai et al. 2010b).

4.3 Inhibitors to adoption and suggestions

Though a great number of older adults in most reviewed studies positively commented on benefits of videoconferencing and enjoyed the novelty of mobility and movement of the mobile remotely controlled videoconferencing-featured devices, several ideas emerged that indicated reluctance to use the technology among older adults. The most common theme is that older adults felt unfamiliar with the technology and/or were confused about how to use it (Beringer et al. 2013; Boman et al. 2014a; Boman et al. 2014b; Moyle et al. 2014; Moyle et al. 2019; Moyle et al. 2020; Seelye et al. 2012; Tsai et al. 2010b; Zamir et al. 2021). In this case, an amount of learning was required to use videoconferencing. In the studies by Boman et al. (2014a) and Zamir et al. (2021), older adults are more likely to use technologies that they were familiar with as they would feel more confident in using them. Also, in the study by Zamir et al. (2018), when it was explained that the residents did not need any skill in using video-calls, as staff would set up the calls, they were keen to be part of the project.

Some residents in included studies commented on the disadvantages of "being seen" or privacy issues (Beringer et al. 2013; Boman et al. 2014a; Moyle et al. 2020; Zamir et al. 2021). This stemmed from the idea that some older adults were not confident with their appearance. Older adults raised concerns about cyber security issues as they think that they are vulnerable to these security breaches (Moyle et al. 2020; Zamir et al. 2021). Interestingly, there were concerns about an increased isolation as they think that this technology might replace in-person contact (Beringer et al. 2013). Furthermore, some study participants wanted to see how others would use the technology before they decided to use it (Zamir et al. 2021).

Technological devices and older adults' conditions are another two major aspects that hindered the use of videoconferencing. The poor sound quality created difficulty in participating in a video call and added to the confusion of using the technology (Zamir et al. 2018). The poor internet connection and a blurred image caused by the inbuilt camera of the devices also made older adults not enjoy videoconferencing (Banbury et al. 2017; Moyle et al. 2020; Tsai et al. 2010b). The brightness of the screen and its incompatibility with the environment also raised concerns while using videoconferencing (Boman et al. 2014a). Older adults' conditions, such as osteoarthritis of the hands, made the devices too heavy to hold independently by older adults. It was also difficult for older adults to press the screen icons on the iPads with the strength needed for an action, especially among those living in RACFs, as they might be frail or arthritic (Moyle et al. 2020). Furthermore, cognitive impairments created difficulties and led to mis-dialled calls or hesitation in making calls (Boman et al. 2014b).

For improving the technology to be suited to some older adults' conditions, study participants suggested that it is important to receive feedback when an action has been done, for example, when a call is connecting (Boman et al. 2014a; Boman et al. 2014b). A study participant said that it could be useful to receive both visual and audio feedback. Other study participants commented that it could be a good idea to have a picture in the contact list containing a dialling function. The participants with dementia pointed out that it should be possible to adjust the features of the videophone to each individual's needs and wishes or habits, interests and abilities (Boman et al. 2014a; Boman et al. 2014b). The participants with dementia agreed that the most important thing was that the videophone should be flexible, user-friendly, and easy to use and some people with dementia expressed that they were disappointed in designers of new technology because they do not investigate what the users want, need and can use (Boman et al. 2014b). Regarding the devices, aged care residents seem to prefer devices that looked more human, which is not as simple as tablets. Residents in the study by Zamir et al. (2021) used materials that represented human features such as eyes, a nose to decorate the SoW device. Additionally, they referred to the SoW as having feet. In the study by Moyle et al. (2019), many participants suggested making the Giraff more colourful adding humanoid features so that it looked more human. In the study by Boman et al. (2014b), participants also emphasised that the design should be modern and attractive. In the case of lost devices, residents suggested that the device should be able to respond when just saying "videophone" out loud. Interestingly, when introducing technology, it is suggested that videoconferencing should not be introduced and categorised as an assistive technology; instead, it should be introduced as a product which is a pleasure to use (Boman et al. 2014a; Boman et al. 2014b).

4.4 Issues arising from the adoption in RACFs

There were a number of issues brought about by the adoption of videoconferencing in RACFs. Besides concerns on residents' conditions and the internet connectivity within nursing homes, RACF staff-related issues emerged as a significant challenge. For instance, the availability of staff members to assist/manage telepresence robots was found to be limited (Moyle et al. 2014). The study by Zamir et al. (2021), found that RACF staff were worried about learning new things to facilitate technology-based activities as they are busy with their existing tasks. As mentioned in their study, staff who were less confident in using the device studied were less willing to commit to the project. On the other hand, as many people living in RACFs suffer from complex conditions, even with iPads, it is challenging for them to make video-calls without adequate staff assistance (Moyle et al. 2020).

Furthermore, a lack of involvement of residents' family also emerged as a challenge brought about by the adoption of videoconferencing in RACFs. The study by Zamir et al. (2021) pointed out that it is difficult getting family to commit to video-calling. There are several reasons causing this hesitation, for instance, a busy schedule of family members, differences in time zones with family who are living overseas, belief of family members that older people cannot make use of technology because of ageing and cognitive impairments, and the relevant technological skills of family members themselves who may also be aged 65 and over and lack skill (Zamir et al. 2021). A lack of digital literacy among family aligns with previous research with older adults aged 80 and over on InTouch, which is a software running on Android-based tablets supporting asynchronous communication (Neves et al. 2015).

5 Discussion

In this paper, we have conducted a systematic review of the literature examining older adults' experiences of using videoconferencing for social connectedness. The review enabled us to investigate what is currently known about this topic and how much the use of videoconferencing within this context varies. It is worth noting that this topic is mostly being explored by researchers in the field of geriatrics and nursing. Videoconferencing has been integrated and used with different devices, ranging from

laptops (Tsai et al. 2010b) or tablets/iPads (Banbury et al. 2017; Moyle et al. 2020) to mobile remotely controlled telepresence robots (Moyle et al. 2014; Moyle et al. 2019; Seelye et al. 2012). The varied designs of devices indicate the continuous adaptation of technology to be appropriate for older adults, especially those with dementia living in RACFs.

Since the beginning of the COVID-19 pandemic, the adoption of communication technologies, particularly videoconferencing technology, to enable older adults to connect with others has increased, especially in RACFs where the visiting restrictions have been established (Haase et al. 2021; Sacco et al. 2020). Interestingly, existing research indicates that aged care residents are more sastified with video calls than with traditional telephone calls when they were given assistance to establish communication (Sacco et al. 2020). While some themes have been consistent among studies (e.g. older adults' positive attitudes toward using videoconferencing), other themes might still be controversial, for instance, benefits of videoconferencing for social connectedness in long-term use. This resulted from the belief that there might be increased social isolation because videoconferencing potentially replaced in-person interactions in the future (Beringer et al. 2013). The increased adoption of videoconferencing in RACFs during the pandemic and inconsistencies in the findings of existing research indicates the needs of further study on this topic. Drawing on the studies reviewed, we make some recommendations for the future design and implementation of videoconferencing among older adults living in RACFs, and opportunities for IS research in this topic.

5.1 Design recommendations

Drawing on findings from the papers Banbury et al. (2017); Boman et al. (2014a); Moyle et al. (2020); Tsai et al. (2010b); Zamir et al. (2018), we note that the audio-visual quality of the calls via videoconferencing needs to be improved. This could be achieved by using the devices with a high-quality camera and ensuring the consistent internet connectivity of the devices. For some residents, hearing aids might be needed during conversations via videoconferencing (Tsai et al. 2010b; Zamir et al. 2018). With regards to tablets, some models are too heavy to hold independently by older adults (Moyle et al. 2020). Therefore, when adopting this kind of device, consideration should be given to its weight. Complaints about the heaviness of tablets were also found in the study of a bespoke tablet application called InTouch (Neves et al. 2015). In that study, older adults overcame this barrier by resting the tablet in their arm and having others help them lift the device (Neves et al. 2015). This further confirms that staff assistance in the use of technology among residents is essential. Furthermore, whereas some study participants preferred technology that they were familiar with using, some others suggested that the design should be modern and look more human (Boman et al. 2014b; Zamir et al. 2021). Therefore, this aspect needs further investigation.

The software used needs to be designed and tailored to older adults' competency and conditions. For instance, as suggested by Boman et al. (2014a) and Boman et al. (2014b), ease of use, feedback and affordances are significant design principles in the development of user-centered technologies for older adults living with dementia. More co-design research with older adults with dementia is needed to find appropriate solutions to maximize the benefits of videoconferencing for older adults, especially those living in RACFs to stay socially connected. Another opportunity for future research in designing videoconferencing experiences for older adults is an integration of virtual assistants (e.g. Siri, Alexa, etc.) as residents suggested that devices should be able to respond to their voices. Moreover, as current videoconferencing featured technology used by older adults merely provide 'talking', 'hearing', and 'seeing' experiences, the adoption of a shared interactive videoconferencing technology (e.g. IllumiShare (Junuzovic et al. 2012), OneSpace (Cohen et al. 2014), ShareTable (Yarosh et al. 2013), etc.) could add more value and foster their engagement. This kind of interactive videoconferencing technology has been found beneficial for children but has not been studied among older adult users (Inkpen 2013).

5.2 Implementation recommendations

Based on the findings, we draw some recommendations for aged care providers to adopt to achieve a greater likelihood of sustainability in the introduction and implementation of this technology. Firstly, a mobile remote-controlled robot (e.g., Giraff) is more expensive than a tablet but requires less staff assistance. Conversely, tablet devices are more affordable but expensive in terms of the staff assistance required. Therefore, either robots or tablets can be utilised, depending on the needs of residents and resource constraints of the care home. In terms of adopting telepresence robots, a due consideration on residents' perceptions of using such technology regarding cyber security concerns should be given and as mentioned by Moyle et al. (2020), this topic should be considered in future research. Moreover, aged care providers need to familiarize residents with the technology and ensure that they are aware of its

purposes and features since some residents might be confused why their loved ones were on the screen, but they could not touch them. This recommendation was highlighted in the reviewed papers (Beringer et al. 2013; Boman et al. 2014a; Boman et al. 2014b; Moyle et al. 2014; Moyle et al. 2019; Moyle et al. 2020; Seelye et al. 2012; Tsai et al. 2010b; Zamir et al. 2021).

In addition, although the number of staff needed for facilitating videoconferencing via telepresence robots might be less than via tablets, staff assistance is still essential in the use of both forms. To avoid staff getting scared and worried about learning new things or reluctant to adopt videoconferencing due to being busy with other tasks, aged care providers might need to offer incentives for assistance to those who involved themselves in the activities or normalize the videoconferencing activities on a regular basis. Also, as staff who were less confident in using the devices studied were less willing to commit to the activities, it is recommended that aged care providers should provide adequate training or establish a good communication channel for staff to understand and enhance their knowledge of the technology that is going to be deployed. Additionally, there might be a lack of staff availability and it is important to have family involvement. However, family might be busy with their work or there may be differences in time zones with family who are living abroad. Therefore, a timetable for conducting videoconferences might need to be set up with availability of staff and residents for family to choose at their convenience. This would help family, staff, and residents find more appropriate times to set up videoconferencing. Aged care providers should also ensure family members have the ability to use technology by providing them with frequent, flexible, and brief training sessions (Neves et al. 2015).

5.3 Opportunities for IS research

Whatever the technological devices featuring videoconferencing were studied, research on this technology and older adults is mostly descriptive with little interpretation as to why the results occurred. Meanwhile, to achieve a greater likelihood of success and sustainability in the deployment of videoconferencing for social connectedness in RACFs, it is essential to answer this why question. From an IS perspective, an approach to answering this why question in a formal way is strengthening its theoretical component. Among fourteen articles included, only two papers refer to existing theories that are commonly used in IS to explain the phenomenon that they were studying or were found in their research. For instance, Zamir et al. (2021) refers to the theory of diffusion of innovation (Rogers 1995) to support the idea that older adults are less likely to adopt new technologies unless they have a clear understanding of the benefits of using them. Zamir et al. (2018) refers to the social engagement and attachment theory (Porges 2003) to emphasize the importance of seeing one another's faces during communication. Meanwhile, findings reported in the paper by Moyle et al. (2020) is, to some extent, aligned with the Senior Technology Acceptance & Adoption Model (STAM) (Renaud et al. 2008). For instance, Moyle et al. (2020) found that the use of videoconferencing is inhibited by age-related cognitive decline and physical frailty; whereas, STAM includes a component called *user context*. Examples of the user context include demographic variables and personal factors such as age and functional ability (Renaud et al. 2008). Moreover, Moyle et al. (2020) found that videoconferencing is an *unfamiliar technology for many residents and hard to use at the start*, *taking some practice* and *need assistance from staff* but seen as *a good way of communicating with family and friends*. These themes align with four components in STAM, namely, *ease of learning & use*, *experimentation & exploration*, *facilitating conditions,* and *perceived usefulness*, respectively. The alignment with IS theories suggests that future research should be either informed or driven by existing theories or put forward novel theories. The use of IS theories also suggests that the effectiveness of these technologies needs to be evaluated within the context of their wider organisational environment of use.

Furthermore, based on the findings of this review, it can be implied that the adoption and use of videoconferencing for social connectedness in RACFs has been facilitated and challenged by multiple sociotechnical factors. These include the technology itself (e.g. the design and quality of audio-visual features of the devices and software offering videoconferencing), its value (e.g. the perceived benefits of videoconferencing for residents), residents' conditions (e.g. residents' cognition, hearing, vision, mobility, and other health conditions), RACF staff issues (e.g. their capability in facilitating videoconferencing and their willingness to adopt this innovation), organizational aspects of RACFs (e.g. the capability in deploying videoconferencing such as the availability of skilled staff, the technological infrastructure within the facilities, and the normalization of the videoconferencing program as part of routines), involvements of external stakeholders (e.g. supports from residents' family members), and the iterative adaptation of the technology to the environment overtime (e.g. the continuous improved designs of the devices offering videoconferencing). These factors are closely related to domains in the NASSS (Non-adoption, Abandonment, Scale-up, Spread, and Sustainability) framework proposed by Greenhalgh et al. (2017). This implication has opened opportunities for further interdisciplinary

research (HCI in tandem with IS) utilising this framework to study complex challenges and opportunities brought about by the adoption and use of videoconferencing for social connectedness among older adults living in RACFs from sociotechnical perspectives.

6 Conclusion

This paper has reviewed the literature focusing on older adults' experiences of using videoconferencing for social connectedness. The strength of this review is the inclusion of a wide range of scientific databases and the utilization of the PRISMA guidelines. However, since the research narrows the focus down to the use of videoconferencing among older adults for social connectedness, this review was limited to fourteen articles, as this is an emerging field of research. This limited number of reviewed papers and a variation of study design included did not enable us to do meta-analysis. This topic is predominately being explored by researchers in the field of geriatrics and nursing. By investigating user experience on the use of videoconferencing across studies, this review could be a useful reference for researchers, technology vendors, aged care providers, aged care workers, older adults, their families, and other relevant stakeholders in considering how videoconferencing should be designed, developed and used effectively for social connectedness in later life.

7 References

Australian Institute of Health and Welfare. 2018. "Older Australia at a Glance," AIHW, Canberra.

Banbury, A., Chamberlain, D., Nancarrow, S., Dart, J., Gray, L., and Parkinson, L. 2017. "Can Videoconferencing Affect Older People's Engagement and Perception of Their Social Support in Long-Term Conditions Management: A Social Network Analysis from the Telehealth Literacy Project," *Health & social care in the community* (25:3), pp. 938-950.

Beringer, R., and Sixsmith, A. 2013. "Videoconferencing and Social Engagement for Older Adults," in *Technologies for Active Aging*. Springer, pp. 189-199.

Boman, I.-L., Lundberg, S., Starkhammar, S., and Nygård, L. 2014a. "Exploring the Usability of a Videophone Mock-up for Persons with Dementia & Their Significant Others," *BMC geriatrics*.

Boman, I.-L., Nygård, L., and Rosenberg, L. 2014b. "Users' and Professionals' Contributions in the Process of Designing an Easy-to-Use Videophone for People with Dementia," *Disability Rehabilitation: Assistive Technology* (9:2), pp. 164-172.

Bruce, M. L. 2002. "Psychosocial Risk Factors for Depressive Disorders in Late Life," *Biological psychiatry* (52:3), pp. 175-184.

Chen, Y.-R. R., and Schulz, P. J. 2016. "The Effect of Information Communication Technology Interventions on Reducing Social Isolation in the Elderly: A Systematic Review," *Journal of medical Internet research* (18:1), p. e18.

Chi, I., and Chou, K.-L. 2001. "Social Support and Depression among Elderly Chinese People in Hong Kong," *The International Journal of Aging and Human Development* (52:3), pp. 231-252.

Cohen, M., Dillman, K. R., MacLeod, H., Hunter, S., and Tang, A. 2014. "Onespace: Shared Visual Scenes for Active Freeplay," *CHI'14*, pp. 2177–2180.

Dudman, J., Meyer, J., Holman, C., and Moyle, W. 2018. "Recognition of the Complexity Facing Residential Care Homes: A Practitioner Inquiry," *Primary Health Care Research & Development* (19:6), pp. 584-590.

Gong, X., Ni, Z., and Wu, B. 2020. "The Mediating Roles of Functional Limitations and Social Support on the Relationship between Vision Impairment and Depressive Symptoms in Older Adults," *Ageing & Society* (40:3), pp. 465-479.

Greenhalgh, T., Wherton, J., Papoutsi, C., Lynch, J., Hughes, G., Hinder, S., Fahy, N., Procter, R., and Shaw, S. 2017. "Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-up, Spread, and Sustainability of Health and Care Technologies," *Journal of medical Internet research* (19:11), p. e367.

Haase, K. R., Cosco, T., Kervin, L., Riadi, I., and O'Connell, M. E. 2021. "Older Adults' Experiences with Using Technology for Socialization During the Covid-19 Pandemic: Cross-Sectional Survey Study," *JMIR Aging* (4:2), p. e28010.

Hemberg, J., and Santamäki Fischer, R. 2018. "A Window toward the World: Older Adults' Experiences of Becoming in Health and Developing as Human Beings through Interacting with Others Using Real Video Communication," *Holist Nurs Pract* (32:2), pp. 90-97.

Inkpen, K. M. 2013. "Kids & Video: Playing with Friends at a Distance," in *Connecting Families*. Springer, pp. 95-123.

Junuzovic, S., Inkpen, K., Blank, T., and Gupta, A. 2012. "Illumishare: Sharing Any Surface," *CHI'12*, pp. 1919-1928.

Kristoffersson, A., Coradeschi, S., and Loutfi, A. 2013. "A Review of Mobile Robotic Telepresence," *Advances in Human-Computer Interaction* (2013.

Moher, D., Liberati, A., Tetzlaff, J., and Altman, D. G. 2009. "Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The Prisma Statement," *Annals of internal medicine* (151:4).

Moyle, W., Arnautovska, U., Ownsworth, T., and Jones, C. 2017. "Potential of Telepresence Robots to Enhance Social Connectedness in Older Adults with Dementia: An Integrative Review of Feasibility," *Int Psychogeriatr* (29:12), pp. 1951-1964.

Moyle, W., Jones, C., Cooke, M., O'Dwyer, S., Sung, B., and Drummond, S. 2014. "Connecting the Person with Dementia and Family: A Feasibility Study of a Telepresence Robot," *BMC geriatrics* (14:1).

Moyle, W., Jones, C., Dwan, T., Ownsworth, T., and Sung, B. 2019. "Using Telepresence for Social Connection: Views of Older People with Dementia, Families, and Health Professionals from a Mixed Methods Pilot Study," *Aging & Mental Health* (23:12), pp. 1643-1650.

Moyle, W., Jones, C., Murfield, J., and Liu, F. 2020. "'For Me at 90, It's Going to Be Difficult': Feasibility of Using Ipad Video-Conferencing with Older Adults in Long-Term Aged Care," *Ageing & Mental Health* (24:2), pp. 349-352.

Neves, B. B., Franz, R. L., Munteanu, C., Baecker, R., and Ngo, M. 2015. "" My Hand Doesn't Listen to Me!" Adoption and Evaluation of a Communication Technology for The'oldest Old'," *CHI'15*.

Porges, S. W. 2003. "Social Engagement and Attachment: A Phylogenetic Perspective," *Annals of the New York Academy of Sciences* (1008:1), pp. 31-47.

Rajanen, M., and Rajanen, D. 2019. "Usability: A Core Concept in Socio-Technical Systems Development," *STPIS@ ECIS*, pp. 9-16.

Renaud, K., and Van Biljon, J. 2008. "Predicting Technology Acceptance and Adoption by the Elderly: A Qualitative Study," *Proceedings of the SAICSIT on IT research in developing countries: riding the wave of technology*: ACM, pp. 210-219.

Rogers, E. M. 1995. *Diffusion of Innovations*, (4th ed.). New York: Simon and Schuster.

Sacco, G., Lléonart, S., Simon, R., Noublanche, F., and Annweiler, C. 2020. "Communication Technology Preferences of Hospitalized and Institutionalized Frail Older Adults During Covid-19 Confinement: Cross-Sectional Survey Study," *JMIR mHealth & uHealth* (8:9), p. e21845.

Schuster, A. M., and Hunter, E. G. 2019. "Video Communication with Cognitively Intact Nursing Home Residents: A Scoping Review," *Journal of Applied Gerontology* (38:8), pp. 1185-1196.

Seelye, A. M., Wild, K. V., Larimer, N., Maxwell, S., Kearns, P., and Kaye, J. A. 2012. "Reactions to a Remote-Controlled Video-Communication Robot in Seniors' Homes: A Pilot Study of Feasibility and Acceptance," *Telemedicine and e-Health* (18:10), pp. 755-759.

Thach, K. S., Lederman, R., and Waycott, J. 2020. "How Older Adults Respond to the Use of Virtual Reality for Enrichment: A Systematic Review," in: *32nd Australian Conference on Human-Computer Interaction (OzCHI '20)*. Sydney, NSW, Australia: ACM, New York, USA.

Thomas, J., and Harden, A. 2008. "Methods for the Thematic Synthesis of Qualitative Research in Systematic Reviews," *BMC medical research methodology* (8:1), p. 45.

Tsai, H.-H., Tsai, Y.-F., Wang, H.-H., Chang, Y.-C., and Chu, H. H. 2010a. "Videoconference Program Enhances Social Support, Loneliness, and Depressive Status of Elderly Nursing Home Residents," *Aging and Mental Health* (14:8), pp. 947-954.

Tsai, H. H., and Tsai, Y. F. 2010b. "Older Nursing Home Residents' Experiences with Videoconferencing to Communicate with Family Members," *Journal of clinical nursing* (19:11-12), pp. 1538-1543.

United Nations. 2017. "World Population Ageing."

Waycott, J., Wadley, G., Schutt, S., Stabolidis, A., and Lederman, R. 2015. "The Challenge of Technology Research in Sensitive Settings: Case Studies in 'Sensitive Hci'," in: *Proceedings of the Annual Meeting of the Australian Special Interest Group for Computer Human Interaction*. Parkville, VIC, Australia: ACM, pp. 240-249.

Wu, B. 2020. "Social Isolation and Loneliness among Older Adults in the Context of Covid-19: A Global Challenge," *Global health research and policy* (5:1), pp. 1-3.

Yarosh, S., Tang, A., Mokashi, S., and Abowd, G. D. 2013. ""Almost Touching:" Parent-Child Remote Communication Using the Sharetable System," *Proceedings of the 2013 conference on Computer supported cooperative work*, pp. 181-192.

Zamir, S. 2020. "Skype on Wheels: Implementation of Video-Calls to Reduce Feelings of Loneliness and Social Isolation for Older People Living in Care." University of Plymouth.

Zamir, S., Allman, F., Hennessy, C. H., Taylor, A. H., and Jones, R. B. 2021. "Aesthetically Designing Video-Call Technology with Care Home Residents: A Focus Group Study," *Frontiers in Psychology*.

Zamir, S., Hennessy, C. H., Taylor, A. H., and Jones, R. B. 2018. "Video-Calls to Reduce Loneliness and Social Isolation within Care Environments for Older People: An Implementation Study Using Collaborative Action Research," *BMC geriatrics* (18:1), pp. 1-13.

Acknowledgements

This research is supported by a Melbourne Research Scholarship and an Australian Research Council Future Fellowship award (grant number FT170100420).

Copyright

Copyright © 2021 Thach, Lederman & Waycott. This is an open-access article licensed under a Creative Commons Attribution-NonCommercial 3.0 Australia License, which permits non-commercial use, distribution, and reproduction in any medium, provided the original author and ACIS are credited.

View publication stats