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Guidelines for Developing the VR Program in Residential Aged Care: a preliminary study from staff members' perspective

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Abstract: Despite there being evident benefits of using virtual reality (VR) in aged care, it is not yet widely used in residential aged care homes. One factor that may contribute to this is the willingness of staff to use VR as part of the social program offered in aged care homes. Therefore, it is essential to seek more understanding about staff perceptions of VR programs, especially suggestions for improvement. In an analysis of responses from 10 staff working for an aged care provider, we found that staff have concerns about the suitability of VR for older people with cognitive impairments and mobility restrictions. Many older adults living in aged care have these conditions. While these are valid concerns, our findings suggest that providing responsible staff with training on various kinds of valuable VR experiences and a clear picture of its benefits and drawbacks should be prioritized to make it suitable for the characteristics of the common aged care cohort. Furthermore, there should be greater investment in technological infrastructure and co-design of VR.

CCS CONCEPTS • Human-centered computing~Human computer interaction (HCI)~Interaction paradigms~Virtual reality

Additional Keywords and Phrases: Virtual reality, older adults, residential aged care, technology adoption

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1 INTRODUCTION

Research has shown that there are some benefits of virtual reality (VR) in aged care. It helps older adults to reduce their apathy [1] and to replace enjoyable activities that they can no longer take part in [2]. Moreover, VR can help older adults feel less socially isolated [2; 3]. Despite these benefits, there has been low uptake of VR among older adults. Not many Australian aged care organizations have introduced and deployed this technology in their residential aged care facilities (RACFs) [4]. Several RACFs have recently introduced this technology to provide residents with opportunities to engage in fulfilling and calming experiences or activities that support their emotional needs [5-7]. The reason for this low uptake might be because of the fact that RACFs are sensitive and complex environments where people typically have high care needs [8; 9] and therefore, the adoption of VR in this setting is challenging [10-12]. Challenges have been recently highlighted by Baker et al. [12] and Zhao et al. [11] including usability issues related to VR systems, residents' mobility constraints, physical discomfort, and challenges in providing guidance and support for residents using VR.

Research suggests that staff need to be on board as facilitators in order to encourage uptake [11; 13]. Therefore, there is a need to investigate staff attitudes to VR in RACFs to see why there is limited uptake. Initial findings from a recent study indicated that although the VR program in RACFs is perceived by staff as a creative innovation and valuable for some aged care residents, it is challenging to implement a VR program within RACFs due to the complexity arising from residents' conditions and the technology itself, and the complicated challenges for staff who facilitate VR activities and those who provide training [10]. In aged care settings, there are still aged care residents who would not be suitable for the VR program and the VR program has been perceived as a high-risk activity by some staff members [10]. It has also been found that the technology including head-mounted display (HMD) devices and the experiences provided in VR activities needs to be adapted to be more appropriate for aged care residents. Furthermore, there needs to be more training among involved staff [10]. However, there is still a lack of information regarding which characteristics of residents make them more or less suitable for the VR program? What changes should be made in terms of VR devices and applications to cater for these characteristics? What training should be provided for staff members? These questions need to be addressed to help the implementation of the VR program in RACFs achieve a greater likelihood of success. As abovementioned, RACF staff play a critical role during VR experiences yet their views on VR have not be comprehensively studied. Thus, the study presented in this paper aims to address this gap by surveying RACF staff. Drawing on their responses, suggestions will be made to improve the future development of VR in RACFs.

2 LITERATURE REVIEW

Residential aged care facilities (RACFs), also known as residential aged care homes or nursing homes, are complex environments involving residents with complex conditions and multi-co-morbidities [14]. In June 2019, over half of all Australian residential aged care residents had a diagnosis of dementia [15]. Dementia is an umbrella term describing conditions associated with an ongoing decline of the brain and its abilities, characterized by the impairment of brain function, including language, memory, perception, personality and cognitive skills. Dementia usually occurs in people who are aged 65 and over. After the age of 65 the likelihood of developing dementia doubles every five years [15].

There are many technologically innovative approaches to supporting older people requiring long-term care both in the community and residential care. During the last ten years, research in the field of technology in aged care has increased. These technologies have specifically brought benefits in promoting independent living,

improving medication management, reducing social isolation and increasing social connection, identifying and managing falls, predicting the risk of falling, managing chronic disease, supporting people with cognitive issues particularly dementia, reducing or managing depression and enhancing well-being, and supporting family and other informal carers [4].

The CARE-IT survey by Barnett et al. [4] asked Australian aged care providers to assess their organizations' project governance in respect to technology and innovation. It found that the adoption of telehealth/telecare as part of standard care requires a range of non-technological interventions, in particular, a structured approach to its integration into workflows, standards and systems. The issue is not whether technology is an appropriate part of the care provision system, but how it can best be integrated and used to maximum effect. Most of the aged care organizations surveyed have commented that technology should not be selected for technology's sake, but for its potential to add value and enhance care quality and outcomes. Furthermore, the survey indicates that "often it is not the technology itself that can limit its adoption but a perceived lack of relevance to its utility and the absence of co-designed processes for its integration". The survey indicates that the key to develop technologies that are fit for purpose is co-design. One example of co-design research of VR experiences for older adults and with older adults is the study by Hodge et al. [16]. The survey suggests that older people and service providers are the end users who need to be engaged in this process. However, less than half of aged care organizations surveyed are engaged in co-designing digital care and support solutions. The majority of organizations surveyed do not assess potential workforce members for their digital literacy as part of their recruitment and selection process. The survey suggests that there is the need for workforce training and development. Even with the impact of COVID-19, the adoption of some technological services such as telehealth is dependent on individuals and their willingness to engage with the services [4].

In the literature, HCI researchers have been investigating the design and evaluation of emerging technologies in RACFs. Gaver et al. [17] built the Photostroller, which is "a waist-high, portable unit whose most noticeable features are a large screen, a removable control unit and rounded handles and wheeled legs", for supporting residents in engaging with the world. One of the sources of the social complexity that the research team witnessed is the considerable diversity among the residents. The differences varied from personal histories and previous employments, current interests and orientations, preferences for sociability or solitude, and attitudes towards the care home, to their immediate cognitive and physical abilities. Some residents were involved in relatively stable social groups; others were more isolated. They welcomed technological innovations that allowed them to look beyond their immediate environment, for instance, explorations of Google Earth [17].

Meaningful relationships and social connection have been identified as important for wellbeing in older adults. There has been significant growth in digital smartphones, robotic, and web-based technologies that can be used to connect residents with family and friends. Common commercially available technologies, such as iPads and web-connection software (e.g. Skype, FaceTime), have been shown to improve sense of connection for RACF residents [18]. Moyle et al. [18] has explored current use and availability of communication technologies for use by residents within RACFs and found that both the use and availability of electronic communication technologies are currently limited within RACFs. One important barrier identified relates to the reluctant attitude of staff to integrate technology within care and a presumption that residents would not want to use the technology over more traditional means. Some facilities stated that they did not 'do much' with technology because of the complex health conditions of the residents and lack of certainty around the relevance of technology use to their facility. Another key issue likely relates to the lack of provision within facilities to

accommodate web-connection communication, for example Internet access or Wi-Fi establishments at the site. Moreover, a lack of available and accessible technologies within facilities might also contribute to the limited uptake of advanced technologies [18].

The use of digital technologies is already recognized as a vital element in building healthcare systems that can accommodate the recognized increase in elderly citizens. However, the training of aged-care workers, either in home or aged-care environments, regarding technology use has appeared to be deficient [19]. Findings from the survey conducted by the Aged Care Industry Information Technology Council National Home Care Group in 2014 highlighted a low level of technological readiness in Australia [20]. According to the work of Miller and Jones [19] drawing on an extensive review of the current National VET training packages [21], it was determined that no core training in technology for use with older people is available [42].

Studies on technology adoption in aged care settings show that older adults are less likely to adopt new digital technologies and are more likely to discontinue use with age [22; 23]. The reasons for this might not only associate with users' demographics such as social class, education, income, gender, living settings [24], but they are also influenced by a range of other factors such as inadequate design, lack of accessibility, inadequate digital literacy, and disadvantaged sociotechnical contexts [25]. The adoption of technology in RACFs has been expected to help the aged care organization to reduce the burden on caregivers [26]. However, previous research indicates that implementation of technology in RACFs might create tensions for staff members in terms of technology use [27]. Staff face challenges due to a lack of proper training [27; 28]. Also, new technology is often viewed by RACF staff as 'disruptive' because it creates changes in their daily task routines [27]. A lack of involvement of staff is emerging as a challenging issue in technology adoption in health care organizations [29].

In addition, a review study [29] identified some emerging issues in information technology and communication (ICT) implementation raised by relevant stakeholders such as older adults and aged care management. The study reveals that factors affecting the decision to use technology among older people in aged care are educational and technological background, health conditions, perceived need for technology, social interaction, technological design, reliability, usability, affordability, confidentiality, and privacy and security. From management's perspective, lack of knowledge about technology products and skills, lack of involvement of lower-level staff, the quality of documentation and complexity of sharing information across organizations, and lack of ICT integration are emerging as dominant issues [29]. These findings indicate that the adoption of technologies in residential aged care settings are significantly complex in nature. While the literature and the recent CARE-IT report [4] suggest that RACFs should embrace technology and there are number of good technological solutions to use, the desires and ability of staff has reduced uptake.

When it comes to VR, several aged care providers are incorporating this kind of technology into their dementia-specific services providing reminiscence experiences, for instance, countries visited, with aiming to enhance residents' mood, wellbeing and social engagement. A systematic literature review conducted by Thach et al. [13] indicates that the engagement of older adults in using VR might be affected by factors such as the physical design of technology (e.g., its look and weight); the types of virtual experiences (e.g., travel and reminiscence-based experiences); and the integration of multi-sensory modalities [13]. The opportunity to involve family members may also be important, and could provide older adults with the ability for sharing experiences with and obtaining support from their loved ones; and experience facilitation, which could provide the ability to ensure that the activities in the VR experiences were being performed correctly [30] - and hence a need to consider the experience of staff in evaluating VR in this setting. These findings illustrate that the

adoption of VR requires the involvement of the various dimensions of a socio-technical system, particularly the personnel in the system.

Four types of challenges brought about by the use of VR among older adults in RACFs were identified by Zhao et al. [11] including: usability, mobility constraints, physical discomfort, and facilitator guidance. There are two types of usability issues when observing participants interacting with VR systems including the use of handheld controllers and the navigation through the system. Zhao et al. [11] suggest considering alternative control systems or modified handheld controller options. This suggestion has been aligned with the design recommendation in the review study by Thach et al. [13]. Remaining seated in a wheelchair is needed among residents with mobility constraints. Zhao et al. [11] revealed that residents had to ask the researchers for assistance to move the wheelchair to reach certain virtual objects. Risks of falling have been also increased among this group of residents due to the disconnection between immersive game play and the residents' awareness of their real position. Moreover, it was hard for facilitators to communicate through gestures or other body languages when residents were wearing HMD devices. Facilitators also found it difficult to monitor residents' emotions and reactions. Different language backgrounds have also challenged the provision of instructions and led to instructions by touching the resident' hands, shoulders or face. Although it is vital to have facilitators during VR activities, some residents, especially those with cognitive impairments, were confused by verbal instructions from facilitators and the immersion in the VR activity was sometimes impacted by facilitators' conversations [11]. These findings have emphasized the critical role of experienced and well-trained facilitators when introducing VR in RACFs.

Findings from a recent study by Thach et al. [10] indicated that although the VR program in aged care homes is perceived by staff members as a creative innovation, likely to fit with task routines and practice within the aged care homes, and valuable for some aged care residents in which a number of residents enjoy VR experiences, it is challenging to implement a VR program within RACFs due to the complicated challenges involving staff who facilitate VR activities and those who provide training, and the complexity arising from residents' conditions and the technology itself. There needs to be more training among involved staff members [10]. In aged care settings, there are still aged care residents who would not be suitable for the VR program and the VR program has been perceived as a high-risk activity by some survey respondents. Also, the technology including HMD devices and experiences provided in VR activities need to be adapted to be more appropriate for aged care residents. However, in this study, there is still a lack of information regarding staff views on which characteristics of residents would not be suitable for the VR program? What changes should be made in terms of VR devices and applications? What training should be provided for staff members? These questions need to be addressed to help the adoption of VR in RACFs achieve a greater likelihood of success.

The complexity brought about by the adoption of emerging technology, particularly VR, in RACFs, increases the need for workforce training and development, the needs to be a structured approach to the integration of technologies into workflows, the need for improvements in technology governance in aged care organizations, the absence of co-designed processes which play a key in developing technologies that are fit for purpose in RACFs, and the indispensable role of staff members in the VR program. Thus, it is essential to seek more understanding about staff members' perceptions of the VR program, especially regarding the three abovementioned questions. In this paper, we present initial findings about staff members' perceptions of these issues. Their responses can enable us to answer the question of what should be prioritized to develop the VR program in residential aged care at this stage.

3 METHODS

3.1 Research design

In this research, we have partnered with an aged care provider that has recently purchased VR headsets for use across their facilities (pseudonym: Aussie Aged Care). Though RACFs' residents and staff are main adopters in this technology-based program, because of the critical role of staff members, who act as facilitators in VR activities, data has been collected through the lens of staff members. It should be noted that this research is taking place during the Covid-19 lockdown across Australia. As aged care organizations have established restricted access to all their nursing homes, it is not presently possible to interact with residents but is possible to contact staff through online surveys. Data collected has been subjected to simple descriptive analysis. Five open-ended questions were used to survey Aussie Aged Care staff members:

1. In your experience of using VR in aged care, what are the main benefits that VR provides to residents?
2. What are the characteristics of residents who would not be suitable for the VR program?
3. What changes would you recommend in VR devices and/or applications?
4. What training should be provided for staff for successful adoption of VR?
5. In your experience of using VR in aged care, what are the main challenges of the VR program?

3.2 Case description

Aussie Aged Care (AAC) is an Australia-wide aged care organization providing clinical care and social and recreational programs for residents. They aim to be innovative and are open to finding ways of using technology to provide opportunities for residents to be entertained. The VR program is part of AAC's mission to redefine the aged care experience in AAC. The program involved introducing Oculus Go VR headsets to all AAC homes in Australia. The program aimed to provide calming experiences for residents to foster socialization and happiness, to provide a novel form of entertainment for residents, and to address agitation and aggression. Agitation and aggression are challenging behaviors that some people with dementia can exhibit [14], and that the VR program is intended to be a way of providing a non-pharmaceutical intervention to address these behaviors. VR is expected to give AAC residents the chance to experience activities and destinations they would not otherwise be able to experience. Using VR headsets, the residents are transported to places around the world, and experience activities they have always loved or wanted to try.

4 RESULTS

There have been 10 responses from AAC lifestyle coordinators with 9 Females and 1 Male. The respondents have been coded as from AAC 1 to AAC 10. It should be noted that the survey is taking place during Covid-19 lockdown in aged care and staff have less time than usual to participate in research and so an initial 10 responses is encouraging. The respondents pointed out that VR is beneficial for residents in terms of helping them calm down, reduce boredom, and increase happiness (AAC 1), reminiscing (AAC 3), fun (AAC 2, AAC 3), and providing new and enjoyable experiences (AAC 3, AAC 5, AAC 6, and AAC 9). Also, a lifestyle coordinator responded: *"residents can travel the world with VR and can see underwater world, they can feel whatever they want to feel"* (AAC 4). VR helps residents *"Get away from where they are for a few minutes"* (AAC 10). Notably, AAC 7 revealed that VR could be helpful for pain management, he said *"VR provides residents with something different and exciting to see, helps with pain management diverting attention from pain to the experience"*.

Most respondents point out that residents with clinical conditions, cognitive issues, and dementia would not be suitable for the VR program. For instance, in responding to the question "What are the characteristics of residents who would not be suitable for the VR program?", AAC 2 described: *"Residents with cognitive decline, often feel confused and [the headset is] very heavy on their head, mobility restrictions especially neck / stroke, vision impaired residents eg wearing glasses under VR"*; AAC 9 responded: *"Dementia residents & those that suffer from vertigo, anxiety or mental health issues"* are residents who would not be suitable for the VR program; AAC 6 further revealed *"Every resident is different... A resident who does not like touch would not let even a family member to place it on a head"*. These and other issues might exclude the residents from using VR technology including the familiarity with using technology with residents (AAC 8 and AAC 10) and their willingness to try out VR devices (AAC 1, AAC 3, and AAC 6).

Most respondents mentioned about heavy headsets and the need of HMD to be simpler and adjustable. For instance, in responding to the question "What changes would you recommend in VR devices and/or applications?", AAC 3 commented: *"The design is too heavy, tight and makes them feel claustrophobic. Maybe something they can hold up to their faces and adjust as required";* AAC 2 mentioned: *"to be very simple, big screens would be more suitable than heavy goggles on individual resident"*; AAC 6 suggested: *"our VR has straps which can be taken off so may be strapless VR in addition to the strap ones"*. Some respondents mentioned about proposed changes of the experiences provided in VR activities. For instance, the experiences should be easy access to more travel and different countries videos (AAC 9) or the experiences should have different themes (AAC 4). Furthermore, there is a lack of connectivity between VR devices and iPad (AAC 4 and AAC 10). Notably, AAC 5 mentioned about the need for improving the Wi-Fi connection within the home.

In terms of the question "What training should be provided for staff for successful adoption of VR?", most lifestyle coordinators suggested that more ongoing and updating of VR use training should be provided. For instance, respondents suggested: *"it should be ongoing training in regard of the updates, may be if its only 30 minutes session"* (AAC 6); or *"basic training and refresher, also would be good to discuss what VR programs people are enjoying and not enjoying"* (AAC 2). Also, a respondent (AAC 3) mentioned: *"more training in general. I haven't received any formal training"*, Some respondents specified that more training should be provided about *"how to use it"* (AAC 10) and *"its benefits"* (AAC 4). Furthermore, AAC 9 explained: *"Current staff require further training, as some staff do not know how to operate VR let alone run a program"*.

Some main challenges of the VR program that respondents pointed out are the level of familiarity with technology of residents (AAC 2), limited residents wanting to participate in the program (AAC 3 and AAC 8), challenges in the connectivity between VR devices and iPad (AAC 4 and AAC 10), a lack of skilled team members to run the program effectively (AAC 5, AAC 6 and AAC 9), a lack of clear manuals or instructions (AAC 9), or the activities is perceived as time consuming (AAC 5). Notably, AAC 5 commented that VR is not able to be used for those residents that require extra support and it is most suitable for those who can follow directions, whereas, these are the least needy of their residents.

5 DISCUSSION

This paper presents some initial findings from responses of aged care staff members who have been involved in the VR program in residential care homes. These findings further confirm the benefits of VR technology for aged care residents in terms of enrichment. We use the term *"enrichment"* in this paper to refer to experiences that provide older people with opportunities to engage in activities that support their emotional

needs and social connectedness. This aligns with the common uses in HCI research on technology and ageing [10; 13; 16; 31]. Besides enrichment, VR technology has been suggested by a respondent for pain management among aged care residents as it helps older adults divert attention from pain to the experience. In the literature, VR technologies have commonly emerged within medical research for treating pain [32-40]. Though the literature does not specifically focus on older adults living in residential aged care settings, it has been proved to be an effective strategy mainly based on pain distraction which is well aligned with what has been indicated by the respondents in this study [33]. This alignment indicates that VR could be not only used as an enrichment experience but also as an effective strategy for pain management in residential aged care settings.

Some RACF staff agree that there are some residents who would not be suitable for the VR program [10]. In this study, some characteristics of unsuitable residents have been identified by respondents such as older people with clinical conditions, cognitive issues, and dementia, older adults with mobility restrictions and vision impairments, older people without familiarity with using technology, and those who are not willing to try out VR. Meanwhile, in this environment, there are a great number of older adults living with different levels of cognitive impairment, especially dementia [15], and with complex conditions and multi-co-morbidities [14]. Furthermore, aged care residents are considerably diverse with their educational and technological background [17], which is one of the factors affecting the decision to use technology among older people in aged care [29]. Moreover, older adults face many challenges in learning digital skills due to cognitive limitations [41-43], and/or physical disabilities [44], so providing digital skills training for aged care residents is complex. If older adults with these characteristics are excluded, the VR program would fail due to not many older users taking part. In this situation, instead of excluding people with these characteristics in the VR program, it is essential to adapt the VR program to be appropriate to this group of users so that the benefits of this emerging technology-based program can be realized. Thus, in order to make VR technology work better with older adults in residential aged care, some suggestions have been made as follows:

Firstly, VR devices and applications need to be adapted to aged care residents. As recommended by some RACF staff members involved in this study, HMD devices need to be lighter, simpler and more adjustable since the current devices are too heavy, tight and making users feel claustrophobic, which has been also suggested in the studies by Zhao et al. [11] and Thach et al. [13]. However, one respondent in this present study suggested that big screens would be more suitable for aged care residents. Big screens in this situation possibly refer to the virtual environment that was studied by Moyle et al. [45]. Therefore, further studies comparing the effectiveness of these two types of virtual environment for residents' enrichment are needed. In terms of VR applications, it is suggested by RACF staff members that there should be more travel and different countries videos accessible and different themes available. The needs of including more travel-based applications are aligned with the review study by Thach et al. [13]. Although the respondents did not specify what kinds of different themes they referred to, it can be implied that the themes should be older adult oriented tailored to personal contexts of older adults and integrated multisensory modalities in the applications in order to enhance their experiences during VR activities. Meanwhile, in order to create user-centered experiences, it is vital to conduct co-design research, for example as the study by Hodge et al. [16]. Furthermore, as indicated in the CARE-IT report, as there has been an absence of co-designed processes in Australian aged care providers which are considered as the key to develop technologies that are fit for purpose [4], more co-design and participatory design research on the use of VR among aged care residents are needed to find more appropriate themes of VR applications and confirm these suggestions.

Secondly, as there are current challenges in the technological infrastructure, which mostly refer to a poor Wi-Fi reception and a lack of stable connectivity between devices in some facilities, there is a need to address technology capabilities in aged care organizations. This investment does not only help aged care organizations address the telehealth and telecare services as suggested in the CARE-IT report [4], but also enables the VR program to work better in their RACFs as identified by staff involved in this study. However, in the literature as well as in practice, there is lack of information about the return on investment associated with technology purchases and associated costs [4], especially regarding the investment on emerging technologies for enrichment such as VR, therefore, more studies focused on addressing this gap should be conducted.

Thirdly, as the CARE-IT survey [4] suggests that there is the need for workforce training in the aged care sector and Thach et al. [10] reveals that there needs for more training among staff who have been involved in the VR program, we asked respondents to indicate what kinds of training should be provided. Based on their responses, for instance, they need ongoing and updated training in VR use and more information about the benefits of VR. It can be implied that knowledge of VR technology used in aged care contexts among staff members is insufficient. In other words, staff members have limited understanding of VR technology and how this technology benefits their residents. These responses in addition to the findings by Moyle et al. [18] indicate that some RACFs are generally unsure of the relevance of technology use to their facility. Therefore, enhancing digital literacy for staff members prior to the introduction of the VR program, particularly by providing training regarding various kinds of VR technology that can be valuable in residential aged care as well as a clear picture of the benefits and drawbacks of each technology, should be prioritized at this stage. Because staff have to work with residents with complex health conditions, it is important for them to be also equipped with an understanding of possible challenges brought about by residents' complex conditions in using the technology so that they can be well prepared during the activity facilitation process. Furthermore, as indicated by a respondent, there should be a forum for involved staff members to discuss residents' experiences to see which applications work best with residents and which do not. Also, it would be beneficial to create a library of useful and workable applications and instructions on how to implement them in RACFs. To some extent, it is believed that this solution could address the limited availability of skilled facilitators in the VR program.

6 CONCLUSION

In conclusion, this paper has identified some priorities to develop the VR program in residential aged care settings. Drawing on responses from RACF staff involved in the current VR program in an aged care organization, older people with clinical conditions, cognitive issues, and dementia, and older adults with mobility restrictions and vision impairments are perceived by staff as not suitable for current VR. However, there are a great number of people with these characteristics living in this setting, therefore, to develop the VR program and to achieve a greater likelihood of success in the introduction and implementation of this technology-based innovation in residential aged care, it is suggested that more co-design of VR should be conducted. Furthermore, the aged care organization should invest more on technological infrastructure such as Wi-Fi to reduce frustration by both staff and elder users. More training regarding various kinds of valuable VR experiences as well as a clear picture of the benefits and drawbacks of each kind of VR technology in residential aged care should be provided for responsible staff. Additionally, more research to compare the effectiveness of different kinds of VR in residential aged care is further needed. Also, more research needs to be done around the benefits of VR in RACFs, not only for enrichment but also for other purposes such as pain management.

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