Consumer and Provider Perspectives on Technologies Used Within Aged Care: An Australian Qualitative Needs Assessment Survey

Wendy Moyle1,2,3, Lihui Pu1,3, Jenny Murfield1,3, Billy Sung4, Deepa Sriram1, Jacki Liddle5, Mohamed Estai6, Katarzyna Lion1,3, and The AACT Collaborative

Abstract
We undertook a qualitative assessment of aged care technology needs from the perspective of consumers and providers using a cross-sectional survey that assumed a largely open-response format. We recruited a convenience sample of individuals aged 18 years or older, lived in Australia, and self-identified as either an older adult (n = 133), an informal caregiver of an older adult (n = 27), and/or clinician, healthcare practitioner, and aged care provider (n = 148). Survey responses were analyzed using a descriptive qualitative content analysis approach to interpret meaning from written survey responses. We identified seven themes reporting that technologies used in aged care do not appear to be meeting end-user needs. Supporting the Technology Acceptance Model, consumers and providers perceive usefulness of the technology and its actual ease of use as drivers of acceptance toward gerontechnology. Ten recommendations are proposed to support technology use and the quality of aged care.

Keywords
aged care, needs, survey, technology, COVID-19

What this paper adds
• An understanding of technology needs within aged care services in Australia.

Applications of study findings
• Understanding the needs of caregivers, older adults and care providers and healthcare professionals will assist the future design and development of technologies for older adults.
• Ten evidence-based, needs-led technological priorities for gerontechnology are proposed to assist gerontological practice.

Manuscript received: January 3, 2022; final revision received: June 8, 2022; accepted: July 28, 2022.

1Menzies Health Institute Queensland, Griffith University, Brisbane, QLD, Australia
2School of Nursing & Midwifery, Griffith University, Brisbane, QLD, Australia
3Australian Aged Care Technologies Collaborative, Griffith University, Brisbane, QLD, Australia
4School of Management and Marketing, Curtin University, Perth, WA, Australia
5School of Information Technology and Electrical Engineering, University of Queensland, Brisbane, Australia
6The Australian eHealth Research Centre, CSIRO, Perth, WA, Australia

Corresponding Author:
Wendy Moyle, School of Nursing & Midwifery, Menzies Health Institute Queensland, Griffith University, Health Sciences (N48), 170 Kessels Road, Nathan, Brisbane, QLD 4111, Australia.
Email: w.moyle@griffith.edu.au
Introduction

Like many countries internationally (United Nations Department of Economics and Social Affairs Population Division, 2019), Australia has a rapidly aging population (Australian Institute of Health and Welfare, 2018). As the number of adults over the age of 65 years continues to increase, we must take steps to accommodate and prioritize the wellbeing of this demographic (World Health Organization [WHO], 2020). An aging population demands different resources, brings unique challenges, and benefits, and has an economic impact (WHO, 2020). Importantly, technology may help us manage some of these challenges, assist older adults to “age in place,” and realize the benefits including improved quality of life (Finch et al., 2017; Moyle, 2019; Schulz et al., 2015). The global COVID-19 pandemic has emphasized this further (Chen, 2020).

Currently, technology is used in a wide and expanding assortment of applications within aged care (Pilotto et al., 2018), ranging from assessment and monitoring artificial intelligence (e.g., wearable devices); assistive and robotic technologies (e.g., robotic wheelchairs; therapeutic social robots); information and communication (e.g., electronic medical records); to caregiver supports (e.g., robotic feeding spoons, fall detection). Although the innovation of these technologies is exciting and commendable, the translation from concept to use within aged care services has been slow and fragmented (Pilotto et al., 2018; Peine & Neven, 2019). Uptake of technology has been increasing over the last decade (Anderson & Perrin, 2017), but remains dependent on older adults’ usability of the technology (Gettel et al., 2021). To move beyond this, two key issues have been identified to better harness the potential of technologies used within aged care: (1) a more comprehensive understanding of end-users’ technology needs and preferences (Pilotto et al., 2018; Peine & Neven, 2019; Pruchno, 2019) and (2) greater synergistic and multidisciplinary working collaborations between specialists in gerontology and technology.

Building directly on the above two issues, we established the first Australian collaborative dedicated to technologies within aged care services across acute, residential, and community care settings—the Australian Aged Care Technology Collaborative (AACTC). The AACTC seeks to increase efficiency, effectiveness, and quality of care of older adults in aging services by identifying appropriate technology products and real-world solutions. This study aimed to gather foundational data to understand end-users’ (consumers and providers) experiences to inform the development of future technological priorities for gerontechnology in Australia and more broadly.

Methods

Design

We undertook a needs assessment of technologies used within aged care using a cross-sectional survey design that assumed a largely open-response format. Grounded in naturalistic inquiry and the constructivist paradigm (Guba & Lincoln, 1989), we used a descriptive qualitative content analysis approach (Braun & Clarke, 2022; Hsieh & Shannon, 2005) to interpret meaning from raw data provided within the written survey responses of participants.

We had ethical approval from Griffith University Human Research Ethics Committee, and we followed the Standards for Reporting Qualitative Research (O’Brien et al., 2014) (Supplementary Material File 1).

Research Team

The AACTC research team consists of a broad multidisciplinary group of scientists, researchers, and sector leaders from aged care, artificial intelligence, biochemistry, computer science, electronic engineering, gerontology, health economics, medicine, neuroscience, nursing, occupational therapy, psychology, robotics, and social work, as well as family caregiver representatives. The authorship team was from nursing, gerontology, psychology, medicine, occupational therapy, and biochemistry.

Participants and Procedure

To capture different perspectives, we developed three surveys tailored to three participant groups: (1) older adults aged 65 years or older; (2) informal family caregivers of older adults aged 65 years or older; and (3) clinicians, healthcare practitioners, and aged care service providers. Although we intended the surveys to be international, few participants from countries other than Australia completed the survey. We therefore excluded these data from analyses: $n = 3$ older adults; $n = 0$ family caregivers of older adults; $n = 4$ clinicians, healthcare providers, and aged care service providers.

Convenience sampling was used to recruit participants for the three surveys. This involved participants voluntarily responding to promotional activities that included advertisements via Australian-based community, advocacy, and/or volunteer organizations (i.e., StepUp for Dementia Research); an online consumer research panel provided by Qualtrics (Qualtrics, Provo, UT, USA); online posts via websites and social media; and word-of-mouth. Participants could complete a survey if they self-identified as either an older adult aged 65 years or above (survey 1), an informal family caregiver of an older adult aged 65 years or above (survey 2), or a clinician, healthcare practitioner, or aged care service provider (survey 3). All participants had to be aged 18 years or older and living within Australia.

Surveys could be completed online (Limesurvey GmbH, Hamburg, Germany) or on paper with a pre-paid return. At the start of each survey, introductory text informed participants that their responses were voluntary and anonymous, and that survey completion constituted their formal informed consent. We also outlined that most questions required a free-text written response.
We piloted all three surveys in February 2020 through an internal process with members of the AACTC (which included consumer and provider representatives). From their feedback, we made minor changes within each survey to enhance readability, including additional written comments to help guide respondents through the survey (i.e., “This section asks four questions about technology you use to support...”) and bolded font to emphasize key aspects of questions. Final versions of surveys were available to complete between April and October 2020. Although not intentional, this data collection period coincided with Australian federal, state, and territory government lockdowns in response to the COVID-19 pandemic.

**Measures**

All surveys began with questions about the demographic profile of participants and their use of different technologies over a typical week. Based on a review of the literature and the expertise of the AACTC members, we then included a set of core questions about use, satisfaction, problems, and challenges with technology across six domains: physical health, mental health, social wellbeing, quality of life, independence, and access to aged care services (Table 1). These questions varied slightly in wording and focus depending on the participant group. For example, we asked older adults about technology to support their personal needs, whereas we asked family caregivers about technology to support their personal needs and their care recipients. Finally, we included a free-text box at the end of all surveys for participants to write any other comments. Most survey questions were open-ended, with closed-response questions used to capture demographic information and technology use. Participants could write as much or as little as they wanted to in the free-text boxes (i.e., there were no character limits in the online survey), and no question was mandatory.

**Data Analysis**

Data collected online were converted into three participant-specific databases within Microsoft Excel, and we manually entered the surveys completed on paper into their respective databases. We checked all databases for missing data and eligibility, and we included surveys containing a sufficient response (at least one open-ended question completed). This resulted in the removal of 181 cases (n = 56 older adults; n = 21 family caregivers of older adults; n = 104 clinicians, healthcare providers, and aged care service providers).

For the quantitative analysis, we imported the three datasets individually into IBM SPSS Statistics for Windows version 27.0 (IBM Corp, Armonk, NY). We produced descriptive statistics for variables relating to demographics and technology use.

### Table 1. Overview of questions within the three surveys.

| Participant group | Focus | Domain | Questions within each domain |
|-------------------|-------|--------|----------------------------|
| Older adults      | Own needs | 1. Physical Health | a. What technology, if any, do you use to help support…? |
|                   |        | 2. Mental Health  | b. Overall, how satisfied are you with the technology you currently use to help support…? |
|                   |        | 3. Social Wellbeing | c. What problems are there, if any, with the technology you currently use to support…? |
|                   |        | 4. Quality of Life | d. What are the biggest challenges to…. that you think technology or innovation could help with? |
|                   |        | 5. Independence | |
|                   |        | 6. Access to Aged Care Services | |
| Family caregivers | Own needs as a family caregiver | 1. Physical Health | a. What technology, if any, do you use to help support…? |
|                   |        | 2. Mental Health  | b. Overall, how satisfied are you with the technology you currently use to help support…? |
|                   | Care recipient needs | 3. Social Wellbeing | c. What problems are there, if any, with the technology you currently use to support…? |
|                   |        | 4. Quality of Life | d. What are the biggest challenges to…. that you think technology or innovation could help with? |
|                   |        | 5. Independence | |
|                   |        | 6. Access to Aged Care Services | |
| Clinician & Providers | Older adult needs | 1. Physical Health | a. What technology, if any, do you use to help support…? |
|                     |        | 2. Mental Health  | b. Overall, how satisfied are you with the technology you currently use to help support…? |
|                     |        | 3. Social Wellbeing | c. What problems are there, if any, with the technology you currently use to support…? |
|                     |        | 4. Quality of Life | d. What are the biggest challenges to…. that you think technology or innovation could help with? |
|                     |        | 5. Independence | |
|                     |        | 6. Access to Aged Care Services | |
|                     | Needs as clinicians & provider | 7. Aged Care Service Provider Needs | a. What are the biggest clinical and/or administration challenges you face that you think technology or innovation could help with? |
|                     |        |                  | b. What kinds of technology or innovation do you think could help improve aged care services in general, including clinical and administration aspects? |
For the qualitative analysis, we imported the three datasets individually into NVivo (QSR International Pty Ltd). To meaningfully condense the raw data and interpret it in line with the study’s aims, we used a qualitative content analysis approach that was both directed and conventional (Braun & Clarke, 2022; Hsieh & Shannon, 2005). First, we used directed content analysis to identify codes that reflected survey questions deductively. We then adopted a conventional, inductive approach, whereby codes that could not be previously categorized were derived from the raw data. We initially coded the three datasets separately for all analyses but considered them whole during the formulation of themes. To begin, DS organized the data within each dataset by undertaking open, line-by-line coding that involved applying data-driven labels to groups of words, phrases, or sentences to capture their meaning at the latent and manifest level. Throughout this process, DS met regularly with KL and JM to review the analysis and discuss the developing codebooks. Once all data were coded, DS, KL, and WM worked together to compare iteratively, contrast, and consolidate the codes generated, first within each dataset and then across the three datasets. As a result, similar codes were grouped together to create themes and subthemes that represented the main issues within the data. The described process was continuously reviewed and discussed with KL and JM until final themes and subthemes were agreed.

Trustworthiness of the data was achieved by the processes of credibility, dependability, authenticity, transferability, dependability, and confirmability. As this was an anonymous survey, member checking was not possible. The researchers sought to establish credibility by ensuring that different people’s voices were heard within the data presented, and an external check of the research process by the external members of the AACTC was undertaken when they read and commented on the draft paper. The researchers sought dependability by ensuring the research process was logical and clearly documented. The data was appraised critically, and through discussion with the research team, they checked that the results were transferable between the researchers and those being studied by using thick descriptions in the data sources. When the researchers met, they questioned their integrity through reflection on whether they were critical in their analysis.

We used directed content analysis to identify codes that reflected survey questions deductively. We then adopted a conventional inductive approach whereby codes that could not be previously categorized were derived from the raw data (Popping, 2015).

Findings

Demographics

The survey was completed by 307 participants: 133 older adults, 27 family caregivers, and 147 clinicians, healthcare practitioners, and aged care service providers. There was good representation of participants from all Australian States and Territories. Older adult participants were typically female, aged between 65 and 74 years, and regular weekly users of computers and smartphones. Family caregiver participants were typically female, aged between 55 and 74 years, and regular weekly users of computers, smartphones, telephones, and tablets. Just under half of all surveyed family caregivers lived with their care recipient. Finally, clinicians, healthcare practitioners, and aged care service provider participants were typically female, aged between 25 and 44 years, and worked professionally within residential aged care or primary healthcare (Table 2).

Qualitative Findings

Seven themes were identified. Exemplar quotations from each of the three groups have been reproduced verbatim, with applied standard punctuation to enhance readability and used to show support for each of the themes below.

Theme 1: Increased Use of Technologies Due to COVID-19. Participants described using a wide and disparate array of technologies, and many noted a general increase in their usage since COVID-19. Most participants indicated an increase in videoconferencing (for social/communication purposes), social media, digital health services and, to a lesser extent, online fitness, and mental health programs. In addition, many older adults and family caregivers noted the benefits of digital health services, including telehealth and electronic health records and prescriptions.

Because of COVID I think I will need to use more technology to get involved with projects that I am interested in. Technology will allow this—whether it be through something like Skype or programs like Lumosity or even a virtual gym type class. (Older Adult #164, Female, 65–74 years old)

Remote telehealth such as doctor appointment only available recently due to COVID. I think the ability to access remote services on an ongoing basis would be helpful. (Family Carer #10, Female, 25–34 years)

In turn, a few providers described an increased focus on technology to support remote communication between older adults and their families and friends (e.g., videoconferencing and social media pages and groups). “Skype zoom for families and families to maintain contact, especially when COVID hit” (Residential Aged Care (RAC) provider #276, Female, 25–34 years)

Theme 2: Need for Simpler Technology. Across all three surveys, all but a couple of participants highlighted the need for simpler technology for use within aged care. They identified a range of difficulties in understanding and managing current technology and describing the importance of user-friendly technology that could be used easily by older people. For example, “Most IT devices are so complicated they confuse and discourage me” (Older Adult, #75, Female, 75–84 years)
The biggest hurdles are the age of our clients and their inability to use technology—their inability to learn new skills or afraid of it—the overwhelming amount of information that comes through tech. (RAC Provider, #46, Male, 45–54 years)

One young provider went so far as to say that apps should be written specifically for older people, “There should one app, specific for them, super-easy to use, that works like an old home phone.” (RAC Provider, #49, Female, 18–24 years old)

Many participants wrote about the complexity of current technology interfaces and software, citing difficulties in managing the amount and type of available technologies, which were not always compatible across different platforms and could change after software updates. Interoperability difficulties were challenging for aged care consumers and could discourage using technology to support their needs. “Ease of initial set up of the apps on the devices; compatibility iPad/android—results in need for different apps to what is familiar” (Family Carer, #10, Female, 25–34 years)

Alongside this, most participants also expressed the need for technologies used within aged care to be better designed and user-friendly, particularly concerning increasing accessibility of technology for users with various age-related sensory co-morbidities (i.e., hearing, eyesight).

Reduced eyesight, hearing, coordination, mobility, strength, and range of motion… yet many of the users have two or more of these issues to deal with. Thinking about how it could be accessible to all these people… is really important (Family Carer #29, Female, 55–64 years)

Participants highlighted the importance of developing technology through co-design to ensure that it meets the needs and preferences of aged care users. “Government use of technology - their websites need to be tested by seniors before they go public.” (Older Adult, Female, 65–74 years). Another older adult stated, “None of it (technology) has been co-designed or even designed with the likely users in mind to make it more user-friendly.” (Older Adult, Male, #151, 65–74 years).

Theme 3: Challenges of Accessing Government-Funded Aged Care Services Online. The challenges of using online portals to access and/or manage government-funded aged care services (e.g., My Aged Care) were raised by many participants across the surveys. These online sites were considered too difficult to navigate, with information problematic to find (or go back to) and too generic to meet the individual user’s needs. In addition, system inflexibility and fragmentation meant that older adults and family caregivers often required technical support to access aged care services.

---

**Table 2. Participant characteristics.**

| Characteristic                      | Older adults (n = 133) | Family caregivers (n = 27) | Clinician & providers (n = 147) |
|-------------------------------------|------------------------|---------------------------|-------------------------------|
| **Identifying gender: Female: Male**|                        |                           |                               |
| Male                                | 48 (36.1)              | 3 (11.1)                  | 51 (34.7)                     |
| Female                              | 84 (63.2)              | 23 (85.2)                 | 96 (65.3)                     |
| **Age (years)**                     |                        |                           |                               |
| 18–24                               | 0 (0)                  | 16 (10.9)                 |                               |
| 25–34                               | 2 (7.4)                | 63 (42.9)                 |                               |
| 35–44                               | 0 (0)                  | 31 (21.1)                 |                               |
| 45–54                               | 5 (18.5)               | 15 (10.2)                 |                               |
| 55–64                               | 8 (29.6)               | 20 (13.6)                 |                               |
| 65–74                               | 11 (40.7)              | 1 (0.7)                   |                               |
| 75–84                               | 1 (3.7)                | 0 (0)                     |                               |
| 85+                                 | 5 (3.8)                | 0 (0)                     | 1 (0.7)                       |
| **Living with care recipient: Yes: No** |                        |                           |                               |
| Yes                                 | 13 (48.1)              | 14 (51.9)                 |                               |
| No                                  |                        |                          |                               |
| **Current occupation**              |                        |                           |                               |
| Primary healthcare professional     |                        |                           | 52 (35.4)                     |
| Acute healthcare professional       |                        |                           | 15 (10.2)                     |
| Residential aged care professional  |                        |                           | 66 (44.9)                     |
| Other                               |                        |                           | 24 (16.3)                     |
| **Technology used during typical week** |                    |                           |                               |
| Computer/laptop                     | 116 (87.2)             | 25 (92.6)                 |                               |
| Smartphone                          | 107 (80.5)             | 24 (88.9)                 |                               |
| Telephone                           | 85 (63.9)              | 21 (77.8)                 |                               |
| Tablet                              | 69 (51.9)              | 20 (74.1)                 |                               |
| E-book reader                       | 31 (23.3)              | 7 (25.9)                  |                               |

Note. All variables are reported as n (%). Frequencies and proportions may not add up to n = 133; 27; 148 or 100% due to missing data or rounding.

a Asked only in the survey of family caregivers of older adults.

b Asked only in the survey of clinicians, healthcare practitioners, and aged care service providers.

c Asked in the surveys of older adults and family caregivers of older adults.
The Government’s MyGov site is appallingly over complicated. Language needs to be simplified. If you want to apply for the aged Pension. Why not have that as a heading? Aged Pension Application. Why is it Make a Claim? A claim indicates that you are already in the system. (Older Adult, Female, #72, 65–74 years)

Concerns about the My Aged Care website were also raised by RAC providers and family carers. “My Aged Care is difficult to negotiate through system - too busy. Needs to be broken up more into smaller more user-friendly sections” (RAC Provider, #44, Female, 55–64 years).

However, many participants noted that clinicians and aged care service providers were often the first support points for consumers with a perceived absence of sufficient technical support. For example, an aged care provider stated the following:

My Aged Care is designed to be implemented and used by clients or proxies effectively side-lining caregivers. When patients cannot cope with the system demands GPs have little capacity to help them. (RAC Provider, Male, #40, 55–64)

**Theme 4: Time, Cost, and Privacy as Barriers to Use.** Participants in all three surveys highlighted time, cost, and concerns about security and privacy as barriers to using technology within aged care. Most described that it took time to learn how to use technology effectively—both when using the technology initially and after software updates/developments—which hindered some older adults and family caregivers in using technology to support their needs. For example, I don’t use any [technology] due to not having time. (Family Carer, #55, Female, 55–64 years)

Most participants also highlighted that the general cost of technology was a barrier to uptake and use. Across various settings, from personal homes to acute care, current technology was deemed prohibitively high, and clinicians and providers noted that this disadvantaged organizations and individuals who were unable to afford the latest and/or best technology. Within residential aged care specifically, family caregivers noted that the use of technology by care staff was limited and, when used, was generally not tailored to residents’ individual needs.

A few participants also raised privacy and security as another challenge in using technologies within aged care. Some older adults and family caregivers expressed concerns about sharing their data, believing that it was not always stored securely and could leave them vulnerable to online fraud (e.g., identify theft, internet viruses). “Trust my fear of inviting frauds to my info privacy anyone can hack in” (Older Adult, #209, Female, 65–74 years)

This was reinforced by a few clinicians and providers who noted that older adults were protective of their privacy and personal data in general, and that this reluctance could prevent them from accessing technology to support their needs. “I find older people are scared around having their health record available online” (RAC Provider, #99, Female, 35–44 years). This concern may be warranted, with services targeting older people and caregivers collecting and selling data.

**Theme 5: Improved Awareness and Training.** Many from all three groups of participants from the surveys emphasized the need for improved awareness about technologies available to use within aged care, such as smart integrated technology, and improved training in using the technologies. In general, older adults and family caregivers reflected that they were unaware of the range of technologies available to use within aged care. This made it difficult to know how these technologies could be used to support their specific needs.

I don’t know what technology is out there and works to support safety. You can spend hours looking for information and the right technology but are often still not sure of the right device or system to use. (Family Carer, #34, Female, 65–74 years)

Furthermore, an older adult stated, “Personally, I use technology a lot, but am unaware of its range of applications in aged care services” (Older Adult, #175, Female, 65–74 years). And, an aged care provider stated, “Many older persons are unable to use this technology or are scared to use it – no adequate training available to help older persons learn at their rate.” (RAC Provider, Male #46, 45–54 yrs)

These sentiments were echoed by the majority of clinicians and providers who also perceived a general lack of consumer knowledge about the technologies available to use within aged care. In addressing this, participants identified a need for enhanced training and support in using the technologies. User-friendly guides, practical sessions, and video tutorials were suggested as means of providing training to consumers. “I think there needs to be more support programs for them” (RAC Provider, Female, 18–24 yrs)

**Theme 6: Importance of In-Person Connection.** Although most older adults and family caregivers were largely positive about using technology to support their aged care needs, some also expressed concern about the reliance on technology at the expense of in-person connection. Some consumers noted that they often found it easier and more satisfying to engage with a person than with technology. In addition, some also felt apprehensive that technologies were being used to replace human connection (physical and verbal).

Too much is assumed by making everything only accessible via technology. We are relational beings and taking away the relational contact makes life very difficult for us.” (Older Adult, #99, Female, 65–74 years)

Technology is a link connecting us, but we must be physically attached to get the comfort for others in our personal space. (Family Carer, #167, Male, 65–74 years)
Theme 7: Streamlining Aged Care Administration Systems. Several clinicians, healthcare practitioners, and aged care service providers specifically wrote about the need to streamline aged care administration systems. A few providers noted that the current technological systems within aged care were not well integrated across healthcare settings and were perceived to duplicate administration and increase the potential for error. To address this, providers called for improvements in record sharing via a simple, common platform. “Keeping all of a person’s medical information stored in one place eliminates duplication of paperwork.” (RAC Provider, Female, 35–44 years). Another provider stated, “Improvements in record sharing or a common platform would help greatly. Uniform processes between facilities also.” (RAC Provider, Female, 45–54 years). Finally, “Talking to other systems, too much duplication is done, and that’s how errors come about.” (RAC Provider, #58, Female, 25–34 years)

Discussion

This is the first time that a nationwide survey has been conducted of technologies used within aged care from the perspective of Australian consumers and providers. Although the data is Australian it is assumed that understanding and improving of services through using technology is vital for all countries to ensure a positive experience for consumers and providers. The findings from this survey may help other countries to review their technology needs within aged care.

Unfortunately, the main finding from our qualitative analysis of survey responses is that technologies used within aged care seem to not be meeting end-user needs. Our findings and analysis point to aspects of technology which need attention, to be responsive to needs. Consumers and providers want simple, streamlined, and centralized technology (i.e., connected to a network) that they can find easily and are trained and supported to use (Gélinas-Bronsard et al., 2019; Vaportzis et al., 2017). When consumers and providers have a negative experience of technology their confidence is shaken, and they may report that the technology does not work, or they might not persevere with using it. Involve end-users in the co-design of technology was identified as important in ensuring the real-world needs and preferences of consumers and providers are met (Sumner et al., 2021). For consumers, this included addressing their concerns about the time it takes to learn and use technology, cost, privacy, and replacement of human connection (Gélinas-Bronsard et al., 2019). For providers, this focus was more about health administration systems. The providers’ statement aligns with the recent Royal Commission into Aged Care Quality and Safety in Aged Care (2021) in Australia that recommended universal adoption by the aged care sector of a digital management system, including an electronic medication management system that is integrated with residents’ My Health Record.

Although not intended or foreseen, our data collection period coincided with the COVID-19 pandemic. However, given we targeted three specific groups rather than a broader population, the sample is more than acceptable for such a time during the beginning of the COVID pandemic and the use of a survey. We found that participants described a general increase in their use of technology due to imposed social restrictions and lockdown measures. This increase in use supports recent research (Strutt et al., 2021) and underscores the important role of gerontechnology in aged care in future health pandemics (Chen, 2020). The rate of acceptance of technology determines the extent of using technology in care (Jia et al., 2015; Lee et al., 2003). Acceptance can be mediated by the perceived usefulness of the technology and its ease of use. However, when older adults are institutionalized, the decision to use technology may be made for them. This may result in technologies being chosen that are not suitable for their need. For example, iPads are often the go to technology, but this technology needs consideration when people have eyesight problems and conditions such as arthritis that challenge the use of the touch keypad (Moyle et al., 2020). It is imperative that one-on-one training programs are in place to assist older adults to utilize available technology (Arthanat, 2019). Furthermore, end-users must be engaged in the co-design and co-evaluation of technologies to ensure user-friendly devices. The technology must offer the possibility to do something, such as support connection to others, or to entertain individuals when they have little to do or are lonely. Based on our findings, several evidence-based, needs-led technological priorities for gerontechnology are proposed. At the end of each recommendation, we have indicated the theme or themes these have arisen from.

Recommendations Arising from the Themes

1. Develop an implementation plan to assist the aged care sector in advancing its capacity for technology capability. This can be shared and available for facilities to work on together. (Themes 2, 3, 4, 7)
2. Advocate co-design and co-evaluation of technology as the gold standard and encourage developers to work with older people, providers, and healthcare practitioners to produce affordable, user-friendly, interoperable, and sustainable technology. (Theme 2, 3, 4, 6)
3. Care providers to implement data management technology with clinical records and physical and mental health assessment tools. A shared plan may help to keep the costs within an affordable range. (Theme 7)
4. Support informed technology development and use that protects privacy. (Theme 4)
5. Improve quality of life and care by embedding technologies (e.g., sensors and telehealth) that provide support while not restricting daily life. (Theme 3)
6. Introduce various technology to stimulate, provide pleasurable activities, encourage exercise and social communication. (Theme 1)
7. Improve the digital literacy of staff and family caregivers. When staff feel comfortable with technology they will more readily assist with the adoption. (Theme 5)
8. Regularly review technologies to ensure they are evidence-based. (Theme 2, 3)
9. Develop an online database that summarizes approaches to personalizing technologies and information that supports this. (Theme 2, 5)
10. Encourage developers to work with industry and government to commanulize their technology products and to trial when appropriate in aged care. (Theme 2, 7)

**Study Strengths and Limitations**

The strengths of this study include the large sample of participants from consumers and providers providing qualitative data for analysis and the richness of information around the challenges of using technologies in Australian aged care. There are also limitations, for example, due to the survey methodology employed, we could not seek clarification or probe for further information. In addition, surveys by family caregivers of older adults may have been impacted by survey length, open-response format, and repetitious structure that saw the same questions asked across six domains. The methodological literature suggests that completing open-ended response options in a survey requires more time and effort than closed-ended questions (Dillman, 2007). We note that many people opened the survey but did not complete the survey and this may be related to the length of time taken to complete open-ended questions. There were no questions that were identified as regular missing answer options.

We were also unable to recruit participants from countries other than Australia sufficiently, nor do we know if there were meaningful differences between individuals who chose to complete the survey and those who chose not to. Another limitation is the higher proportion of females in this survey compared to males. However, the literature suggests there are more females than males working and caring for older people (Australian Bureau of Statistics, 2019). Therefore, it can be challenging to achieve a balance of gender, especially when undertaking survey-based research. Finally, the survey did not explore the generational differences in relation to technology use and this needs to be considered when reading the data. Nevertheless, as our findings have implications for gerontechnology broadly, we have chosen to discuss our findings with an international lens.

**Conclusions and Implications**

The perspectives of the older adults, caregivers, and providers have presented an evidence-based overview of technologies used within aged care. Understanding the needs of these groups will assist the future design and development of technologies. Technology that enables and empowers older people may benefit staff, family caregivers, and older residents. Further, technology is more likely to be used by older people and caregivers if it is perceived to be safe, useable, and relevant to needs. Co-design of new technologies is therefore of utmost importance. If these implications are addressed technology could be used to promote independence and may intercept the need for residential aged care.

**Acknowledgments**

We thank the organizations and individuals who assisted with promoting the research such as StepUp Australia and Qualtrics and the participants who took the time to complete the survey. The following members of the AACT Collaborative are acknowledged for their involvement in this study, as listed alphabetically: Elizabeth Beattie, John Butler, Glenda Cook, Mohamed Estai, Najwan El-Safi, Laurie Grealish, Nick Hird, Paul Johnson, Cindy Jones, Penny King, Barbara Klein, Jacki Liddle, Katarzyna Lion, Wendy Moyle, Jenny Murfield, John Nakulski, Tamara Ownsworth, Deborah Parker, Lihui Pu, Sarath Rathnayake, Nicole Robinson, Abdul Sattar, Billy Sung, Michael Todorovic, Haitham Tuffaha, and Lily Xiao.

**Declaration of Conflicting Interests**

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Funding**

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The research was funded by a Menzies Health Institute Queensland 2019 Capacity Grant.

**Ethical Approval**

IRB Approval Number: The study has ethical clearance from the Griffith University Human Research Ethics Committee (GU ref no: 2019/723).

**ORCID iDs**

Wendy Moyle https://orcid.org/0000-0003-3004-9019
Jenny Murfield https://orcid.org/0000-0001-9595-4242
Jacki Liddle https://orcid.org/0000-0002-6336-9898
Katarzyna Lion https://orcid.org/0000-0002-3699-6896

**Supplemental Material**

Supplemental material for this article is available online.

**References**

Anderson, M., & Perrin, A. (2017). *Tech adoption climbs among older adults*. Pew Research Center.
Arthanat, S. (2019). Promoting information communication technology adoption and acceptance for aging-in-place: A randomized controlled trial. *Journal of Applied Gerontology, 40*(5), 471–480. https://doi.org/10.1177/0733464819891045
Australian Bureau of Statistics. (2019). Disability, ageing and carers, Australia: Summary of findings. https://www.abs.gov.au/statistics/health/disability/disability-ageing-and-carers-australia-summary-findings/latest-release/key-statistics
Australian Institute of Health and Welfare. (2018). *Older Australia at a glance.* Cat. no. AGE 87.
Braun, V., & Clarke, V. (2022). *Thematic analysis. A practical guide.* Sage.
Chen, K. (2020). Use of gerontechnology to assist older adults to cope with the covid-19 pandemic. *Journal of the American Medical Directors Association, 21*(7), 983–984. https://doi.org/10.1016/j.jamda.2020.05.021
Dillman, D. A. (2007). *Mail and internet surveys: The tailored design method* (2nd ed.). John Wiley & Sons.
Finch, M., Griffin, K., & Pacala, J. T. (2017). Reduced healthcare use and apparent savings with passive home monitoring technology: A pilot study. *Journal of the American Geriatrics Society, 65*(6), 1301–1305. https://doi.org/10.1111/jgs.14992
Gélinas-Bronsard, D., Mortenson, W. B., Ahmed, S., Guay, C., & Auger, C. (2019). Co-construction of an internet-based intervention for older assistive technology users and their family caregivers: Stakeholders’ perceptions. *Disability and Rehabilitation: Assistive Technology, 14*(6), 602–611. https://doi.org/10.1080/17483107.2018.1499138
Gottel, C. J., Chen, K., & Goldberg, E. M. (2021). Dementia care, fall detection, and ambient-assisted living technology to help older adults age in place: A scoping review. *Journal of Applied Gerontology, 40*(12), 1893–1902. https://doi.org/10.1177/07334648211005868
Guba, E. G., & Lincoln, Y. S. (1989). *Fourth generation evaluation.* Sage Publications, Inc.
Hsieh, H.-F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*(9), 1277–1288. https://doi.org/10.1177/1049732305276687
Jia, P., Lu, Y., & Wajda, B. (2015). Designing for technology acceptance in an ageing society through multi-stakeholder collaboration. *Procedia Manufacturing, 3*, 3535–3542. https://doi.org/10.1016/j.promfg.2015.07.701
Lee, Y., Kozar, K. A., & Larsen, K. R. T. (2003). The technology acceptance Model: Past, present, and future. *Communications of the Association for Information Systems, 12*(50), 752–780. https://doi.org/10.17705/1CAIS.01250
Moyle, W. (2019). The promise of technology in the future of dementia care. *Nature Review Neurology, 15*(6), 353–359. https://doi.org/10.1038/s41582-019-0188-y
Moyle, W., Jones, C., Murfield, J., & Liu, F. (2020). For me at 90 its going to be difficult feasibility of using iPad videoconferencing with older adults in long-term aged care. *Aging & Mental Health, 24*(2), 349–352. https://doi.org/10.1080/13607863.2018.1525605
O’Brien, B. C., Harris, I. B., Beckman, T. J., Reed, D. A., & Cook, D. A. (2014). Standards for reporting qualitative research: A synthesis of recommendations. *Academic Medicine, 89*(9), 1245–1251. https://doi.org/10.1097/jamc.0000000000000388
Peine, A., & Neven, L. (2019). From intervention to co-constitution: New directions in theorizing about aging and technology. *The Gerontologist, 59*(1), 15–21. https://doi.org/10.1093/geront/gny050
Pilotto, A., Boi, R., & Petermans, J. (2018). Technology in geriatrics. *Age and Ageing, 47*(6), 771–774. https://doi.org/10.1093/ageing/afy026
Popping, R. (2015). Analyzing open-ended questions by means of text analysis procedures. *Bulletin of Sociological Methodology, 128*(1), 23–39. https://doi.org/10.1177/0759106315597389
Pruchno, R. (2019). Technology and aging: An evolving partnership. *The Gerontologist, 59*(1), 1–5. https://doi.org/10.1093/geront/gny153
Royal Commission into Aged Care Quality and Safety. (2021). *Final report: Care, dignity and respect, summary and recommendations.* (Vol. 1). Commonwealth of Australia.
Schulz, R., Wahl, H., Matthews, J. T., De Vito Dabbs, A., Beach, S. R., & Czaja, S. J. (2015). Advancing the aging and technology agenda in gerontology. *The Gerontologist, 55*(5), 724–734. https://doi.org/10.1093/geront/gnu071
Strutt, P. A., Johnco, C. J., Chen, J., Muir, C., Maurice, O., Dawes, P., Siette, J., Dias, C. B., Hillebrandt, H., & Wuthrich, V. M. (2021). Stress and coping in older Australians during COVID-19: Health, service utilization, grandparenting, and technology use. *Clinical Gerontologist, 45*(1), 106–119. https://doi.org/10.1080/07317115.2021.1884158
Sumner, J., Chong, L. S., Bundele, A., & Lim, Y. W. (2021). Co-designing technology for aging in place: A systematic review. *The Gerontologist, 61*(7), Article e395–e409. https://doi.org/10.1093/geront/gnaa064
United Nations Department of Economic and Social Affairs Population Division. (2019). *World population ageing 2019: Highlights.* ST/ESA/SER.A/430.
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.org/10.3389/fpsyg.2017.01687
World Health Organization. (2020). *Decade of healthy ageing: Baseline report.* Licence: CC BY-NC-SA 3.0 IGO.