


Technological risks and ethical implications of using robots in long-term care

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Abstract

Introduction: The pandemic provides a unique opportunity to examine new directions in innovative technological approaches in long-term care (LTC) homes. While robotics could enhance staff capacity to provide care, there are potential technology risks and ethical concerns involved in technology use among older people residing in communal aged care homes. This qualitative descriptive study explores the technological risks and ethical issues associated with the adoption of robots in the specific context of LTC homes.

Methods: The research team including patient and family partners employed purposive and snowballing methods to recruit 30 LTC participants: frontline interdisciplinary staff, operational leaders, residents and family members, and ethics experts in dementia care. Semi-structured interviews were conducted. Thematic analysis was performed to identify themes that capture empirical experiences and perspectives of a diverse group of LTC stakeholders about robotic use.

Results: Technological risks include safety, increased workload, privacy, cost and social justice, and human connection. The findings offer practical insights based on the LTC perspective to contribute to the robot ethics literature. We propose a list of pragmatic recommendations, focusing on six principles (ETHICS): **E**ngagement of stakeholders, **T**echnology benefit and risk assessment, **H**arm mitigation, **I**ndividual autonomy, **C**ultural safety and justice, **S**upport of privacy.

Conclusions: There is both a growing interest as well as fear in using robotics in LTC. Practice leaders need to reflect on ethical considerations and engage relevant stakeholders in making technology decisions for everyday care.

Keywords

robots, ethics, long term care, assistive technology, risks, dementia, qualitative study, senior care, social connection

Introduction

The COVID-19 pandemic has had a disproportionate impact on residents living in long-term care (LTC) and exposed persistent inequities in senior care.¹ Virtual communication and various forms of technologies have been perceived as supportive tools for older people and burden-relieving assistance for formal and informal caregivers.² The pandemic provides a unique window to examine new directions in the uses of innovative technology in LTC homes. Older adults and caregivers expect that assistive technology would offer physical and social support to enable effective everyday care and improve quality of

life.³ For example, residents living in LTC homes may connect with online church services, visit museums, and

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receive music group therapy. Research has shown digital devices and social robots to promote social engagement among older people.^{4,5} People who resisted technology before the pandemic now may change their minds about its use because the new digital world allows convenient access to connect with families and friends, as well as essential resources for everyday life. However, the rapid developments in technology and adoption of these tools into LTC homes can also bring unintended harm, burdens, and negative consequences as well.⁶ Recently, telepresence robots - mobile devices on wheels that allows simultaneous communication through videoconferencing,⁷ have been used to support LTC residents to connect with families and friends remotely.⁸ While assistive technology may help enhance staff members' capacity to provide care and benefits for residents, there are potential risks and ethical concerns involved in technology use among older people residing in care homes.⁹ For instance, safety, privacy, and the fear of seeing jobs and human care replaced by robots are common concerns. During the COVID-19 pandemic, although telepresence robots can help with medical and family virtual visits, reducing the risk of spreading contagious disease, the users' concerns, and acceptance in LTC remain unknown. Assistive devices like robots are designed to help the residents living in LTC homes to remain socially engaged and connected with their communities and experience the feeling of close proximity.¹⁰

While there is a considerable amount of conceptual research literature on the ethics around gerontechnology,¹¹⁻¹⁷ current empirical evidence on immediate technological risks and long-term ethical issues, as well as unintended social consequences to both individuals and organizations (such as LTC homes) is limited. Most of these existing studies on technological tools focused on home health care.¹⁸⁻²⁰ As technologies become increasingly complex, pervasive, and interconnected, practical approaches with ethically sound underpinnings are needed to guide product and service adoption. There is a need to ensure benefits, harms, and risks are thoughtfully considered and negotiated with relevant stakeholders in a way that does not place unfair burdens on a particular disadvantaged group (e.g. residents living with dementia and disabilities). A recent systematic review reports that 67% of current assistive technologies for dementia are designed in absence of explicit ethical assessment.¹⁰ This raises serious concerns about the ethical viability of using assistive technologies among older people with dementia. Viability here refers to the feasibility of adopting technology with thoughtful considerations of benefits and ethical concerns.²¹ Ethical concerns such as ensuring fair technology access (distributive justice) and preserving the privacy of end-users have not been fully explored.²¹ Previous reviews also highlight ethical concerns about informed consent, privacy, data security and affordability.²² Other identified ethical implications include stigma, social isolation, user-engagement in

the design process and implementation of the technology as well as the ethical dilemma about whether assistive technologies would replace human care.²³ Thus, there is a need to investigate the views and needs of both people with lived experience and relevant stakeholders about the risks and ethical challenges associated with the use of assistive technologies in LTC. However, only a few empirical studies have captured the opinions of involved stakeholders about their experiences and attitudes towards assistive technologies. Mulvenna et al.²⁴ developed an 'Ethical by Design' Manifesto to engage designers and users to take part in the conversation about making ethically sound decisions about design and application of technology for dementia care. Building on the emerging literature concerning ethical considerations for using assistive technologies in LTC, our study aims to elaborate the technological risks and ethical issues that could emerge in the adoption of robots in LTC homes.

Increasingly, care robots are now used and considered as solutions for LTC in many countries to counter the shortage of nursing staff in the aged care sector. Countries such as Japan, Germany, and the United States are worldwide examples of early adopters of robotics and assistive technologies in LTC where robotics and other smart devices have received some acceptance and promising results from users.²⁵ Wangmo et al.¹⁰ interviewed 20 health professionals (doctors and nurses) in three countries (Switzerland, Germany and Italy) about the use of assistive technology in aged and dementia care; they found diverging opinions on various ethical issues and what should be done to ensure safe and effective use. Challenges are raised when robots are used by 'vulnerable' older adults with frailty and disability. Who should be deciding which robots should be used when and by whom? Some worry that caregivers may become over-reliant on robots to do the caring work, and that technology may replace human care and take away the jobs of health professionals. This article draws on the data from a qualitative descriptive study that explores ethical issues in using assistive technologies in LTC. We provide a detailed analysis of technology risks and ethical implications based on a diverse group of stakeholders: LTC residents and families, frontline staff, operation leaders, and ethics experts in dementia care.

Methods

Recruitment

We applied a purposive sampling approach²⁶ to search for a balance of participants with various demographic backgrounds (ethnic origin, age range, genders, job and experience representations) for the first wave of interviews. The demographic backgrounds were obtained in the beginning of the interview. We invited staff participants in two LTC homes at a large health authority in the province of British

Columbia, Canada. From there, a snowballing approach was taken to recruit more respondents through recommendations and referrals by the informants. Both of the LTC homes are publicly funded and occupied by a diverse ethnic population with complex care needs. Over 85% of residents have cognitive impairment or dementias. Most staff (80%) are females and they are diverse in ethnic backgrounds, including descendants and immigrants of European, American and Asian origins. A total of 30 people participated: five LTC residents, two family members, 10 interdisciplinary staff (three nurses, two rehabilitative staff, two recreation staff and three care workers), seven operational leaders, and six ethics experts within dementia care. The participation of each site is evenly balanced. We included men and women, new and experienced staff with various ethnic backgrounds. Nurses who knew the residents well provided assistance in recruiting the resident participants with diverse characteristics to maximise variation. Among the five resident participants, three were men and two were women, with an age range of 65–92. Three residents have mild dementia; all are able to communicate their opinion. See more information about consent process in the section of ethical consideration.

None of the invited participants refused to participate. The two LTC sites were selected because they had social robots (i.e. PARO) and telepresence robots for resident use. PARO is a social robot (a baby seal) that elicits emotive responses and serves as a social companion. Telepresence robots are mobile and offer video-enabled virtual visits. The ethics experts in dementia were recruited by referral in snowball sampling. Our research team consists of a patient partner living with dementia, a family partner, an educator at the Alzheimer Society, a graduate student, and an academic researcher. All authors were involved to identify potential participants through our networks. We emailed personalized invitations to prospective participants. The first author was responsible for obtaining informed consent from participants, explaining the purpose and the methodology of the study as well as replying to questions. Prior to data collection, all participants provided written informed consent.

Data collection

Semi-structured interviews were conducted to obtain information regarding perceived risks and ethical concerns about the adoption of robots in LTC. Staff participants were asked: (1) What is your opinion on using robots (e.g. social robot PARO, and telepresence robot) in LTC homes. (2) What are the technological risks and ethical issues associated with the adoption of assistive technologies in LTC homes? (3) What is needed to manage the risks for safe and ethical use? We added an additional question about cost for the operational leaders. Also, we adjusted the language to make it plain in the resident interviews. For example, we

asked what do you like or do not like about the baby seal robot and the video robot? Do you have any concerns about these robots? Each interview lasted about 30–60 min; field notes were taken during all the interviews. The nurses at each site asked their residents for permission to allow the researcher to contact them for interviews. The interviews with residents were conducted in person in the dining room of the LTC home. The interviews with all other participants were conducted virtually through Zoom meetings that were audio-recorded and transcribed verbatim.

Thematic analysis

Thematic analysis was performed in six steps, guided by Braun and Clarke.²⁷ Step 1: All authors read and re-read the transcribed text to become familiar with the data. Step 2: The first author generated initial codes by using sensitized concepts in the literature (deductive approach) and concepts found in the data (inductive techniques).⁷ Step 3: Initial themes were developed based on the codes and extracted data. Step 4: The whole team discussed the data and reviewed the themes. Step 5: Collectively, the research team refined the themes and selected extractions for quotations in the write-up. Step 6: The first author wrote the first draft of the manuscript and all authors reviewed and made edits.

Ethical considerations

Ethics approval was obtained from the Research Ethics Board at the University of British Columbia. We booked appointments and sent consent forms and questions to participants a few days before the interview, so they had time to prepare their response to the questions. Participants were provided the primary investigator's email and phone contact for opportunity to ask questions. For the resident participants, we followed current consensus guidelines, treating consent as an ongoing process, seeking assent and respecting any dissent of the resident participants during all research activities.^{28,29} Verbal assent was sought before and during each interview session to remind participants about the purpose of the research and their right to withdraw at any time. A family member also signed the participant information and consent form. All identifiers including names and other details were removed from all data to protect the confidentiality of the participants. Critical reflection was integrated in our research meetings to ensure power is shared, and contributions of all team members were equally respected.

Results

The analysis of data identified five themes on technological risks on use of robots in LTC: safety, increased workload, privacy, cost and social justice, and human connection.

Safety

Safety risk has been viewed as one of the most significant risk concerns for robot use in LTC. Frontline staff participants repeatedly emphasized that the cognitive and physical disabilities of residents made safety risk a priority concern. Although the telepresence robot was designed for autonomous navigation to avoid collision, some participants voiced concerns that mobile robots could malfunction or move into the wrong places, such as bathrooms or areas that were out of bounds. One care worker participant was concerned the mobility issue of the robot would trigger behaviors among residents with dementia.

We cannot have the robots roaming around. We have residents who have dementia. They may not see the robot and trip over, that's a fall risk. I think the robots just confuse people. The robots should not be allowed to go into other residents' rooms. The robots moving up and down the hallways will trigger agitation and confuse people. They will make people mad and the residents will break them. (A care worker)

One rehabilitation staff participant reported the clutter in the hallway and resident room confused the sensors of the robot, hindering optimal movement of the robot. Other nurses also voiced about their worry regarding how the robot could be used as a weapon in situations that involved behavioural events. For instance, a nurse alluded to an incident of an angry resident who pushed the robot to the ground and broke the screen of the telepresence robot. Another nursing supervisor mentioned how the social robot PARO was pulled between two residents in tug of war in a special care unit. Staff talked about the need for risk assessment and risk management to avoid resident conflict/violence to prevent injury among residents. Currently, there is no evidence-based guidance that is specific to robot use in LTC homes, highlighting the need for the development of policy and guidelines to inform risk analysis and safe practice. Operational leaders, frontline staff, residents and families need practical support to guide implementation to ensure safe and ethical use.

Increased workload

Staff also brought up the issue of extra work that is required to care for the robots. For example, robots need to be charged, wiped, disinfected, maintained, and repaired. They also must teach new staff and families about the robots. One participant commented, "We don't have time to even think about the robots when we are short-staffed, trying to keep up with so many new practice and policy every day. We have operational challenge here for all of us." The pandemic brings staffing problems, frontline leaders face a high challenge to deal with the day-to-day clinical practice. The robots are put in the back burner because they are

overwhelmed with implementation of so many infection control policy and procedures. One researcher participant said, "I have seen the hurdle of training. It is a lot of work to motivate people learn about what the robots do and how to use them. Some LTC homes just not have the capacity to adopt new practice and support staff training." A few participants discussed their experiences of enlisting local champions and leaders to support education and adoption. An educator mentioned that they need practical recommendations on how to train and prepare staff, residents, and families effectively. Participants across sites echoed that many of their staff are older and not technology-savvy, they need help to gain confidence, feel safe and comfortable with the robot, suggesting that it takes time and work to provide education and ongoing support. A nurse supervisor summarized the situation well: "If the person doesn't have the support or the training to use it, the robots will not be used. Many of our staff are older, they may not themselves be comfortable with the technology. That can create some barriers." Providing appropriate resources and balancing workload are crucial to enhance adoption of technologies.

Privacy

According to the participants, privacy is another major risk relevant to both staff and residents. A researcher participant voiced her concern about residents being monitored by the camera installed in the robots, unintentionally creating a 'Big Brother' culture of surveillance of residents' lives. Also, residents with dementia may not be aware of the presence of the robot, which can bring unwelcomed intrusion into their daily lives. Although the robot offers an 'end' button on the touchscreen to stop connection, the older person may not be able to see it and know how to use it. Many frontline staff emphasized that people need to be respected in their autonomy, consent, freedom to decline use, and dignity.

One operations leader remarked:

I see opportunities for robots to address issues of social isolation and loneliness by increasing virtual visits with families and friends. At the same time, I see the risk infringing on their privacy. A robot may allow families to have visual access in a public area with a group of residents. The residents may be seen being cared for by staff in intimate situations such as washing.

It is also important to consider staff discomfort and anxiety of surveillance with the robot around them in the care environment. One nurse asked, "Can the telepresence hear us when it is off?" A leadership participant argued, "we have nothing to hide, we provide good care, so we should have nothing to worry about. Families see the other residents, staff and the environment too when they come in to visit." Some felt the invasion of privacy to be a concern

when taking photos and video-recording. Everyone agreed that photographing and recording should not be allowed unless the resident gives consent. Participants remarked that older adults should have control as to when they have contact, as well as how to initiate and end calls. A balance should be made between improving older adults' lives and protecting their rights. The older adults also should be helped to understand what the robots can do (features and functions) in order to enable them to make informed choices whether to use the robots or not. The findings revealed the significance of ensuring privacy for all stakeholders involved when using the robots, including staff and residents.

Cost and social justice

The robot could also stop working or malfunction. In the interviews, it was obvious that the managers were aware of ongoing costs for the LTC homes in replacing and repairing technologies to meet the demands of daily practice. It was interesting that leadership participants told us that the cost is not an issue as long as there are sufficient justifications in terms of resident effects and benefits. According to the leadership participants, residents can be entertained by the social robot and the robots can be objects of conversations and improved social connectedness among residents in the LTC units. They were more concerned about staff's buy-in and acceptance. In contrast, staff were very nervous about the cost of the robot. For instance, one staff member said,

I know the residents would talk about the robots among themselves, had a good time. The robots are stimulating interaction. However, the robots are expensive. We only have two PARO robots here. The problem is how to make them available for residents and by whom. Like now, the recreation staff have been off sick for two weeks; the robots are locked up because they are expensive. No one has access to the robots when the residents need them the most, when family can't come in to spend time with them.

Another participant alluded to the cost to ensure fair distribution as there is a wide range of affordability in LTC homes. Some bigger homes are more able to invest in technology compared to smaller homes. The infrastructure for the LTC home is also vitally important; for example, the Wi-Fi system needs to provide consistent high-speed service. Many staff members complained that they do not have strong internet connection in every resident's room. Some families were able to pay and install personal Wi-Fi in the individual resident room, suggesting an inequity issue to technology access. Other families complained about unstable Wi-Fi in the room, which made private call impossible in the room. A family member told us, "I couldn't have the call in the room because I kept getting kicked out with the loss of Wi-Fi. I'd rather talk with him (husband) in the

hallway, where the Wi-Fi is stronger". It is problematic that some families had to sacrifice privacy for Wi-Fi connection. Many of our staff participants felt strongly about the importance of preserving social equity by ensuring that the level of access to and mechanisms of distribution of robots in LTC benefit all socioeconomic groups in the resident population.

Participants in general agreed that robots can offer support for social connection in LTC. As one nurse participant stated, "Right now, it is just simply not possible for their loved one or family to come here to physically visit. Through a telepresence robot, they can see each other and talk, so important for people, especially for those with dementia who do not understand why their family are not in." A regional director said, "I think that there's certainly a lot of potential there for robotics technologies in LTC, especially during the time that we live in, occasionally having lock-downs within LTC homes, where people aren't able to socialize in the same way." The telepresence robots were especially lauded for their great potential to increase social connection of residents with family members or friends. A recreation staff member noted, "Setting up a phone call on a telephone can take up a lot of time for staff, and it can be difficult to manage when we are short staffed. Telepresence robots can take some of that prep work out of it and make it easier to connect to family members." While some participants expressed that they thought the robots will go a long way in improving efficiency and effectiveness, freeing staff time to provide necessary care, they also emphasized that technology needs to complement and not replace human touch. When considering robotic or technological use in LTC, cost, effectiveness and equity were found to be interconnected.

Human connection

In the interviews most participants believed the robots could be used as tools to improve efficiency, while many also voiced their concerns about robots replacing human care. One participant argued that the social robot PARO can be left with the resident when staff do not have time to spend with the residents: "The robot PARO can be used as a distraction to prevent agitated behaviours or promote co-operation. Yes, the technology helps quiet the resident. Does it mean the resident can be ignored because they're not causing a fuss anymore?" Drawing from her own parenting experience, the ethics expert participant mentioned the salience of having a balance. "I do the same to my kids with the iPad. I let them have tech time as long as it's enjoyable and they're not being neglected." Other participants worried about family preferring virtual visits using the telepresence robots over in-person visits. One ethics expert participant commented, "With the convenience of the robot, family members and friends may no longer feel obligated to visit,

because they have virtually visited them.” On the other hand, a very old resident participant spoke emotionally in the interview, “Many people are very lonely here in this place. I am so lonely and I have no one to talk to. The staff are so busy. Sometimes, I think I would rather die than being so lonely by myself. I am beyond sad. I am angry. Many people feel ashamed to come in to visit because it is a nursing home. I would talk to a robot or anything that helps.” One staff participant mentioned about a pet visit with a volunteer during the time over a COVID-19 outbreak when no one was allowed to visit. The pet visit reduced stress and gave a positive atmosphere to the home. Overall, participants across groups see the benefits of having the robots to allow safe virtual visits, especially when the resident is in isolation with COVID infection. A staff member brought up a recent example about the robot being placed in a resident room to support unlimited visits when the resident was dying. Family members and friends overseas were also able to visit and spend quality time with the resident by singing his favourite songs and playing piano for him. The daughter (family participant) talked in length in the interview about how helpful her family members and friends across the world were able to spend more time with her father because they had the telepresence robot in the room.

My sister was so pregnant; my father had COVID. He was very sick. The technology was amazing. We made family group call ourselves and we did not need to rely on the staff to help us to set up calls. We could move the robot around in Dad’s room and talk to him. It was nice to be able to check on him at night and at different times of the day. My sister was able to spend time with Dad before he passed away. Her baby was born on the day when he died. These family time meant a lot to us. I wish many other people can benefit from such technology as well (Family participant)

It is important to ensure that robots introduced to the residents benefit the person and are not just used to save time, improve efficiency, or reduce burden on staff workload. If possible, every effort should be made to support the ability of residents to exercise self-determination and assert preferences regarding the extent to which robots is involved in everyday care. Quality of life for the older adults should be the end goals of the use of robots in care.

Discussion

This article reports the relevant stakeholders’ perception of technological risks and ethical issues associated with the adoption of robots in the specific context of LTC homes. In the gerontechnology literature, robots have been viewed as potentially useful for those who are lonely, socially isolated,

or cognitively impaired older adults.¹³ However, the voices of direct users (residents, families, frontline staff, etc.) in aged care homes have been missing. Most studies were conducted in people’s their own homes in the community. Integrating an innovative technology into practice in formal institutional LTC environment may bring anticipated and unanticipated benefits, unintended consequences, and harm. Our results contribute to the gerontechnology literature in three ways.

First it expands the understanding of the perceived ethical concerns and risk in robotic use among LTC residents. Participants in the study explained residents, families, and staff have various preferences, needs, and perspectives. In particular real-life context, multiple values (e.g. safety and autonomy) often co-exist causing tension and conflicts. As Sorell and Draper¹⁵ argue, we cannot assume the values that matter to the older population is uniform. Both the older person and caregiver must be included in the negotiation of various values and goals – what matters most. In line with Čaić, Odekerken-Schröder and Mahr,³⁰ our findings suggest the need of a broader perspective of multiple groups of stakeholders to account for particular context. While it is important to focus on the beneficial outcomes, it is also necessary to acknowledge the concerns and take action to ensure a balanced of safe and ethical practice in the care setting.

Second, the study results provide a rich and direct voice of people living and working in the frontline LTC. The two LTC sites have the social robot PARO and the telepresence robot Double and used them during the times of COVID-19 pandemic when many residents experience social isolation and loneliness. Most participants agreed on the positive benefits of the assistive robots to support residents’ needs. Despite the risk of robots replacing human carer has been repeatedly raised by our participants, social and emotional needs are substantial motivators for uptake.

Third, if technology is carefully developed and implemented with frontline staff, technology can lead to an empowerment of the workforce in the digital age.¹⁷ Our proposed recommendations (Table 1) offer practical strategies to guide future conversations, assess technologies and make careful plan to protect people from harm and mitigate risks.

The study has three limitations. First, we only interviewed a small number of stakeholders in each group. It was challenging to recruit residents and family members, as well as frontline staff during the COVID-19 pandemic. Future research should further investigate and compare qualitative experience across diverse LTC stakeholder groups who have opportunity to use the technology for an extended period of time. Second, the participants in the two LTC sites are privileged to have access to social assistive robots. It is possible that previous research project activities aiming to encourage robotic adoption influenced people’s perception

Table 1. Recommendations: ETHICS based on empirical data and literature.

	Data extract example	Literature example
<p>E - Engagement of stakeholders To address ethical tensions that arise in implementing technologies, relevant stakeholders (e.g., residents, families, staff) should be involved in making planning. All plans and decisions must, as much as possible, appeal to reasons that are mutually agreed for shared goals. Decision-makers should document, and be prepared to justify, the decisions that they do or do not make.</p>	<p>I do not think I have time to do this. It becomes problematic when it does not work. We have people with dementia here. They may use it a weapon to hurt others. We do not have a lot of space here. The robot can get in the way (A care aide)</p>	<p>Although many technologies were available to support elder care, they were significantly underused. Efforts should be made to adapt technologies to meet users' needs and preferences and address concerns.²⁰</p>
<p>T - Technology benefit and risk assessment Benefits and harms, risks and burdens should be assessed. Decisions should promote the well-being of stakeholders (resident, family and staff) and increase the common good while minimizing the overall burdens. The distribution of technology should not place unfair burdens on particular individuals/groups, which can perpetuate systemic or structural inequities.</p>	<p>I have seen it (telepresence robot) and used it. I think it is good therapy. Many people here are very lonely and depressed. I know some people worry about it is not a person and it moves around. People can move away from it or shut it down. The robot is a useful tool because it helps people (A resident)</p>	<p>Factors such as social position, age, disability, education, income, gender, and generational status can contribute to inequity. Attention should be paid to ensure technology are developed and implemented as supportive tools, enabling older adults to feel safe, both physically and psychologically.³²</p>
<p>H - Harm mitigation Stakeholders and those impacted by decisions should be protected, as much as possible from harm. If harm cannot be fully mitigated, do the stakeholders view the benefits of the technology outweigh the risks?</p>	<p>Family should be involved to have conversation about how to protect choice and build care plan. People in LTC should be allowed to take risk if everyone agrees it is acceptable and reasonable, if the benefits of the technology outweigh the risks (A family member)</p>	<p>Care ethics focuses on relationships, roles, and responsibilities. The development and evaluation of robots a care context should pay attention to the relational nature of care activities.¹⁴</p>
<p>I - Individual autonomy Pay attention to how procedures and care plan are built to support technology use to protect individual autonomy. Avoid infringements on individual autonomy and choice.</p>	<p>The telepresence robot or PARO may be fine for some people, whereas for other people they can be unacceptable. We have to embrace different people just have different value systems. Some people have immense distrust with technology (An ethics expert)</p>	<p>Older adults should retain the right to control, to grant permission for use, to turn off or decline use. If introduced with foresight and careful guidelines, robots and robotic technology could improve the lives of the elderly.¹¹</p>
<p>C - Cultural safety and justice Practice leaders should inquire diverse perspectives of stakeholders of all groups to ensure inclusion. Respecting stakeholders' worldview and lived experiences, incorporation cultural safety into all aspects of decision-making and practice is essential for justice and fairness. LTC should be environments that are socially, spiritually, physically and emotionally safe. Attempts should be made to ensure that individuals are respected and will not be judged for their identity, age, racial background, and disabilities.</p>	<p>I think it's a fantastic opportunity to use the robotics in LTC. During the pandemic, people really need someone to talk to and something to hold on to. I had a Chinese resident with dementia who passed away a month ago. She always looked for company and she was scared. We gave her the PARO. It was super amazing how much she cared for it. I wish we have more than two (An operational leader)</p>	<p>Companion robots could enrich the social lives of elderly people; social interaction could be facilitated by robots that enabled virtual visits from friends and family. The deception and infantilisation of elderly people that might result from encouraging them to interact with robots as if they were companions.¹¹</p>

(continued)

Table I. (continued)

	Data extract example	Literature example
<p>S - Support of privacy Practice leaders have a responsibility to put appropriate strategies in place to mitigate any risk of infringement of privacy. For example, policies, regulations, practice guidelines should be developed to support for team to deal with ethical challenges. Investment should be made to provide staff education about ethical decision making. Residents, families and all staff should have access to ethicists' support and resources.</p>	<p>One major problem is the robots have camera and can see everyone around. When it goes out to the dining hall, not everyone may want to be seen. I am uncomfortable if it watches me when I provide care (A nurse)</p>	<p>A person with Alzheimer's would probably forget that the robot in the room, and could perform acts or say things thinking that they are in the privacy of their own home. The person's right to their own privacy should be respected.¹¹</p>

about technological risks and ethical implication. Also, both homes are large urban sites; rural homes may have very different preferences, perspectives, and opinion about technology use. Third, education, income, sex and gender, and generational status can contribute to digital inequity among older adults.³¹ We did not investigate intersectionality; how multiple identity factors may impact digital perspectives and experiences. Previous research found older adults with family members or friends who provide encouragement and technological support are more likely to accept health technology.³² Future studies should consider Gender-based Analysis Plus (GBA+) in digital divide research to inform policy and practice.

Implications

There is a growing interest as well as fear about using robotics in LTC. Practice leaders should apply ethical principles and frameworks to support stakeholders in making technology decisions for everyday care. Research is needed to address the broader ethical and societal concerns of these technologies to negotiate best practices in innovating the care of older adults. Also, older adults are not a homogeneous group of vulnerable people.^{33,34} Scholars in the fields of sociology and gerontology point out that the older population has been generalized as a problem to which technology is the solution.^{31,32,35,36} More robust research is needed to better understand the ethical issues and strategies to address risk impact on residents, families, staff and organization leaders in LTC. Based on the results of the interviews and existing literature, we propose six preliminary recommendations for practice leaders to consider. We call them ETHICS: Engagement of stakeholders, Technology benefit and risk assessment, Harm mitigation, Individual autonomy, Cultural safety and justice, and Support of privacy.

Conclusion

This paper offers a unique contribution to the knowledge base of ethics for robot use in LTC. We have three main conclusions. First, we argue for the need to bring relevant stakeholders together to negotiate a wide range of values of both technology benefits and risk in decision making. Second, our practical recommendations, ETHICS provides a useful framework to spark and support conversations for reflexive technology practice in LTC. Third, our study findings suggest more qualitative research is needed to gain a more inclusive understanding of various ethical values of robotic use in LTC - who is affected in what ways, and what can be done to address the risk and burdens of emerging technologies.

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LH and JM developed the methodology and acquired ethical approval. LH, JM, JP were involved in participant recruitment and data collection and analysis. LH drafted the manuscript which was reviewed, edited, and approved by LH, JM, AB, JP and JW.

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References

- Alliance for a National Seniors Strategy. *An evidenced informed national seniors strategy for Canada*. Report. 3rd edition. National Institute on Ageing, Canada. http://nationalseniorsstrategy.ca/wp-content/uploads/2020/09/NSS_2020_Third_Edition.pdf (2020, accessed 3 December 2021).
- Chu CH, Ronquillo C, Khan S, et al. Technology recommendations to support person-centered care in long-term care homes during the COVID-19 pandemic and beyond. *J Aging Soc Policy* 2021; 33: 539–554.
- Johansson-Pajala RM, Thommes K, Hoppe JA, et al. Care robot orientation: what, who and how? Potential users' perceptions. *Int J Soc Robot* 2020; 12:1103. DOI: [10.1007/s12369-020-00619-y](https://doi.org/10.1007/s12369-020-00619-y)
- Hung L, Liu C, Woldum E, et al. The benefits of and barriers to using a social robot PARO in care settings: a scoping review. *BMC Geriatr* 2019; 19: 232.
- Hung L, Berndt A, Wallsworth C, et al. Using touchscreen tablets to support social connections and reduce responsive behaviors in dementia care: a scoping review. *Dementia* 2020; 20: 1–20.
- Fiske A, Henningsen P and Buyx A. Your robot therapist will see you now: ethical implications of embodied artificial intelligence in psychiatry, psychology, and psychotherapy. *J Med Internet Res* 2019; 21: e13216.
- Hung L, Wong J, Smith C, et al. Facilitators and barriers to using telepresence robots in aged care settings: a scoping review. *J Rehabil Assist Technol Eng* 2022; 9: 205566832110723.
- Moyle W, Arnautovska U, Ownsworth T, et al. Potential of telepresence robots to enhance social connectedness in older adults with dementia: an integrative review of feasibility. *Int Psychogeriatr* 2017; 29: 1951–1964.
- Niemelä M, vanAerschot L, Tammela A, et al. Towards ethical guidelines of using telepresence robots in residential care. *Int J Soc Robot* 2019; 13: 431. DOI: [10.1007/s12369-019-00529-8](https://doi.org/10.1007/s12369-019-00529-8)
- Wangmo T, Lipps M, Kressig RW, et al. Ethical concerns with the use of intelligent assistive technology: Findings from a qualitative study with professional stakeholders. *BMC Med Ethics* 2019; 20: 1–11.
- Sharkey A and Sharkey N. Granny and the robots: ethical issues in robot care for the elderly. *Ethics Inf Technol* 2012; 14: 27–40.
- Archibald MM and Barnard A. Futurism in nursing: technology, robotics and the fundamentals of care. *J Clin Nurs* 2018; 27: 2473–2480.
- Vandemeulebroucke T, Dierckx de Casterlé B and Gastmans C. The use of care robots in aged care: a systematic review of argument-based ethics literature. *Arch Gerontol Geriatr* 2018; 74: 15–25.
- vanWynsberghe A. Service robots, care ethics, and design. *Ethics Inf Technol* 2016; 18: 311–321.
- Sorell T and Draper H. Robot carers, ethics, and older people. *Ethics Inf Technol* 2014; 16: 183–195.
- Pirni A, Balistreri M, Capasso M, et al. Robot care ethics between autonomy and vulnerability: coupling principles and practices in autonomous systems for care. *Front Robot AI* 2021; 8: 654298 DOI: [10.3389/frobt.2021.654298](https://doi.org/10.3389/frobt.2021.654298)
- Rubeis G. Guardians of humanity? The challenges of nursing practice in the digital age. *Nurs Philos* 2021; 22: e12331. DOI: [10.1111/nup.12331](https://doi.org/10.1111/nup.12331)
- Nylander S, Ljungblad S and Jimenez Villareal J. A complementing approach for identifying ethical issues in care robotics - Grounding ethics in practical use. In: Proceedings - IEEE International Workshop on Robot and Human Interactive Communication, Paris, France, 9–13 September 2012, 2012, pp. 797–802.
- Vandemeulebroucke T, Casterlé BD, Welbergen L, et al. The ethics of socially assistive robots in aged care. A focus group study with older adults in Flanders, Belgium. *J Gerontol - Ser B Psychol Sci Soc Sci* 2020; 75: 1996–2007.
- Verloo H, Kampel T, Vidal N, et al. Perceptions about technologies that help community-dwelling older adults remain at home: qualitative study. *J Med Internet Res* 2020; 22: e17930. DOI: [10.2196/17930](https://doi.org/10.2196/17930)
- Hall A, Brown Wilson C, Stanmore E, et al. Moving beyond 'safety' versus 'autonomy': a qualitative exploration of the ethics of using monitoring technologies in long-term dementia care. *BMC Geriatr* 2019; 19: 1–13.
- Chapman S, Miller J, Spetz J, et al. *The impact of emerging technologies on long-term care & the health workforce*.
- Locsin RC and Ito H. Can humanoid nurse robots replace human nurses? *J Nurs* 2018; 5: 1.
- Mulvenna M, Boger J and Bond R. Ethical by design - A manifesto. In: *ACM international conference proceeding series*. New York, NY: Association for Computing Machinery, 2017, pp. 51–54.
- Tan SY and Taeihagh A. Governing the adoption of robotics and autonomous systems in long-term care in Singapore. *Policy Soc* 2021; 40: 211–231.
- Patton MQ. *Qualitative evaluation methods qualitative research & evaluation methods: integrating theory and practice*. 4th edition. Thousand Oaks, Calif: SAGE Publications, Inc, 2015.
- Braun V and Clarke V. Using thematic analysis in psychology Using thematic analysis in psychology. *Qual Res Psychol* 2006; 3: 77–101.

28. Dewing J. Participatory research: a method for process consent with persons who have dementia. *Dementia* 2007; 6: 11–25.
29. Black BS, Rabins PV, Sugarman J, et al. *Seeking assent and respecting dissent in dementia research*, 2009.
30. Čaić M, Odekerken-Schröder G and Mahr D. Service robots: value co-creation and co-destruction in elderly care networks. *J Serv Manag* 2018; 29: 178–205.
31. Fang ML, Siden E, Korol A, et al. A scoping review exploration of the intended and unintended consequences of eHealth on older people: a health equity impact assessment. *Hum Technol* 2018; 14: 297–323.
32. Fang ML, Canham SL, Battersby L, et al. Exploring privilege in the digital divide: implications for theory, policy, and practice. *Gerontologist* 2019; 59: E1–E15.
33. Sixsmith J, Fang ML, Woolrych R, et al. Ageing-in-place for low-income seniors: living at the intersection of multiple identities, positionalities, and oppressions. In: *The Palgrave Handbook of Intersectionality in Public Policy*. Cham: Springer International Publishing, 2019, pp. 641–664.
34. Ayalon L and Tesch-Römer C. *Introduction to the section: ageism—concept and origins*, 2018, pp. 1–10.
35. Neven L. By any means? Questioning the link between gerontechnological innovation and older people’s wish to live at home. *Technol Forecast Soc Change* 2015; 93: 32–43.
36. Seifert A, Reinwand DA and Schlomann A. Designing and using digital mental health interventions for older adults: being aware of digital inequality. *Front Psychiatry* 2019; 10: 568. [10.3389/fpsy.2019.00568](https://doi.org/10.3389/fpsy.2019.00568)