ORIGINAL ARTICLE

Adoption of assistive technologies in long-term care homes: What the pandemic has taught us

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Abstract

COVID-19 increased the use of technology in everyday life and highlighted critical applications for assistive technologies. This comparative research study explores how assistive technologies, including socially assistive robots, can be adopted by long-term care homes to mitigate the lasting effects of the pandemic. In particular, we investigated the types of assistive technologies used by long-term care facilities to help with the care of older residents and for what tasks. Furthermore, we identified barriers to adoption and proposed policy measures that encourage technology adoption.

Introduction

The rapid spread of COVID-19 has increased our adoption and usage of technology in everyday interactions, while highlighting a number of critical applications for assistive technologies. Our entire healthcare system has been under unprecedented strain, and we need to consider how robotic technology will help us to improve the quality of care and functionality of our care facilities. Effective care of residents depends on the important roles of care workers. Long-Term Care (LTC) workers are among the most vulnerable workers in terms of work conditions including their physical, emotional, and cognitive burden of work, and overall pay.[1,2]

This international comparative research explores how assistive technologies, including socially assistive robots, can be adopted by LTC homes to mitigate the lasting effects of the pandemic. In particular, we investigated the types of assistive technologies that were available and used by LTC facilities to help with the care of older residents, and for what particular tasks. Furthermore, we aimed to identify which policy measures encouraged the adoption of innovative technologies in these facilities. Also, we sought to recognize what regulations, or "*way of doing things*," were found to be substantial barriers.

We argue that due to the combination of low profit margins in LTC homes, which limit investment capacity in technology, and the relatively low skill profile of workers, it is imperative that governments step in and support new technology development and adoption. Drawing on the LEADS framework,[3,4] we believe that effective health leadership from government is primarily required to achieve system transformation. Governments should consider the following measures: raise awareness among facility managers about the potential of technologies, subsidize new emerging technologies, support worker training, and realign regulations and standards pertaining to technology adoption.

Approach

Our comparative study considered two different healthcare systems: Canada and Israel; and within them a variety of LTC facilities (publicly or privately owned, with older adults with varying cognitive abilities), non-profits, government agencies, and robot developers and implementers, which gave us a unique opportunity to evaluate different policy approaches to the issue of technology adoption, as well as several non-governmental initiatives. The government officials and non-profit advocators chosen for interviews were those that have been responsible (or advocating) for planning, regulating, and encouraging the adoption of new technologies in the LTC sector (i.e., ministry of health representatives and CEOs of non-profits). They were asked about: (1) government actions in this field, (2) their views regarding the potential of robotics and assistive technologies and their effect on care workers, and (3) the main implementation obstacles and government/policy plans. The facility managers or administrators of LTC facilities were asked about how they coped during the pandemic, the extent to which care workers made use of new technologies and what they believe needs to happen to improve technology adoption. All interviewees were asked about different aspects of the worker-technology interface and their awareness or experience with socially assistive robots.

Presenting a comparator to Canada highlights that the challenges to technology adoption are general and not necessarily unique to the Canadian system. Variance in central factors (e.g., worker attitudes to technology) across cases, quite differently, could inform researchers about as-of-yet unrealized possibilities for a specific system that may materialize in the future.[5] Israel, while obviously different

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from Canada in many respects, shares important similarities in terms of its health-related demographics, economy, and technological innovativeness. In particular, life expectancy is 82.6 years of age in Canada and 82.5 years of age in Israel[6]; gross domestic product per capita is $54,917 USD in Canada to $54,930 USD in Israel[7]; and Canada is ranked 15th to Israel's 16th on the Global Innovation Index.[8]

The main objective was to explore whether and how LTC facilities actually deployed assistive technology and robots to address the unique challenges associated with the pandemic. We conducted 12 interviews (7 in Israel and 5 in Canada) with different actors at different levels in the introduction of new technologies into LTC facilities and complemented these with document analyses from different sources (e.g., government reports). Triangulation of information derived from different source types was used to increase the internal validity of this qualitative research.[9,10] We focused on addressing the following research questions:

1. How have new assistive technologies, with an emphasis on socially assistive robots, aided in addressing the pandemic crisis in LTC? How have assistive technologies affected residents and workers? How can they be a part of the effort to mitigate the lasting effects of the pandemic and support our increasing older population? What are the bottlenecks for implementation?
2. Given that LTC facilities were already operating in crisis mode before the pandemic, it is clear that public intervention is required: what policy measures are needed to encourage the adoption of innovative technologies in LTC facilities?

Our objective was to address these questions while focusing on the lived experience of LTC homes. The pandemic created conditions that were strikingly similar across geographic space: (1) increased danger of COVID-19 infections required distancing among residents and between residents and staff; (2) LTC home lockdowns to prevent contact with external carriers; and (3) heightened staff attrition due to stress and significantly increased workload. For the latter, these included frequent COVID-19 screening and testing, performing tasks individually for residents rather than in group settings (e.g., residents being served food in their rooms, while pre-COVID they used to eat together in the dining hall), and having to wear and change Personal Protective Equipment (PPEs) often while performing tasks.[11,12] Moreover, the nature of work in LTC facilities, even in the best of times, tends to be strenuous and pay is low.[13,14]

Findings

The pandemic created extreme conditions in LTC facilities. Technology adoption was required to: (1) relieve the growing caregiver workload burden, (2) alleviate loneliness and social isolation of older adults while providing cognitive and social interventions, and (3) reduce disease/virus-spreading during outbreaks. How were these needs addressed?

There are significant differences between Israel and Canada, as there are among the different Canadian provinces, but these tend to highlight all the more some striking similarities. To begin with, in discussions with policy-makers, non-profits, and facility managers, a broad agreement emerged that new assistive technology adoption is important as a way to alleviate workloads, improve communication, and care especially during the pandemic. A consensus exists that assistive technologies could improve resident care and staff working conditions. Our findings showed that COVID-19 had particularly accelerated the adoption of video communication technology. The technology was mainly used for residents to help them remotely stay in touch with loved ones. Furthermore, we conducted a social robot study in Ontario for COVID-19 screening to help minimize the spread of the virus in LTCs.[15,16] We found that staff were engaged with the augmented Pepper robot and had a high interest in using it; motivating the use of such robot technology from the care staff perspective. In the facilities we interviewed, there was no difference noted in terms of robotics adoption between the public and private long-term care homes.

Policy-makers were generally aware that the introduction of robotic technologies could potentially help mitigate a plethora of problems that emerged due to the pandemic. However, a common observation was that new technology uptake in LTC facilities is slow. The COVID-19 pandemic exerted a strong, albeit ambivalent, effect on technology adoption. The distancing imperative combined with the strain on workers increased the demand for technologies that would allow effective distancing and a reduction in the workload of staff that were overburdened even before the pandemic. On the other hand, precisely since staff were strained during the pandemic, some interviewees thought that facility managers and workers lacked the time and energy required to master the transition to new technologies. A common primary issue was the learning curve for care staff, as they were the ones overseeing the communication between residents and family members, and staff were not trained in using the technology. Hence, the pandemic created a motivation-capacity trade-off of sorts for technology adoption.

To achieve results (one of the five dimensions of the LEADS framework[3,4]), health leadership must strive to identify and remove *barriers*. Beyond specific pandemic-related circumstances, the interviews uncovered several factors that constituted general barriers to new technology adoption. First, technology cost was a concern. In some cases, the cost also involved the need to adapt antiquated infrastructures to new technology requirements. Significant troubleshooting was involved in implementing technology in LTC homes, and basic resources, such as not enough electrical outlets in rooms and unstable Wi-Fi were the biggest hurdles. Second, the workforce is often wary about the use of new assistive

technologies. At times, the concern is simply about a worker's ability to operate the technology without enough training or technology support. Others are worried that new technologies might create more work for over-extended workers. Nevertheless, in both countries, interviewees rejected concerns about robots, or other new technologies, replacing human labour. The current workforce shortages in care work are such that this scenario appears far removed from reality. New technologies could complement human labour—not replace it. Third, some interviewees were concerned that technology introduction involved overcoming different regulatory obstacles. Finally, in Israel, but not in Canada, the possibility that residents—or their families— would reject new technologies, especially robots, was articulated. The sentiment "*we are not like the Japanese*" was voiced to indicate that the local culture is not high on technology receptiveness. However, in Canada, they embraced the introduction of robotic technology.

Government officials are generally aware of the potential importance of new assistive technologies. However, in Israel, actual public support for long-term care assistive technologies is low. Discussions with policy-makers in both countries presented a number of ways they could support appropriate adoption of assistive technologies.

 i. *Subsidies*. LTC facilities operate on tight budgets. During the pandemic, their financial situation worsened due to the cost increases associated with distancing, testing, and the need to retain staff during a health crisis.[17] Even in normal times, facilities find it difficult to afford the purchase of new technologies. In Israel, facility managers complained that their budgets were stretched as it were, so purchase of expensive new technologies (e.g., a robot > $3,000) was unlikely. In Canada, having innovation be supported by funding and/or subsidies was viewed to "*make a huge difference*." Technology donations were gladly accepted, for instance, tablets that would allow residents to communicate with family during lockdowns but were uncommon. Facility managers indicated that subsidies for technology purchase would help, but these were not forthcoming. Clearly, government subsidies (and perhaps loan programs) could help.

 ii. *Raise awareness among facility managers about the potential of different technologies*. The decision whether to adopt a specific technology in LTC settings is made by facility managers. However, awareness of new technologies among facility managers is not high. Different stakeholders— including facility managers—were in agreement that the pace of technology adoption in LTC facilities was slow. Facility managers were frequently unaware of new possibilities and did not actively seek new assistive technologies. Government could disseminate information about new technologies or organize and invite facility managers to care technology exhibitions. Networks in Canada such as AGE-WELL organize annual conferences for individuals in age-related care and the public to attend and interact with the latest assistive technologies being developed by their researchers and start-up companies (https://agewell-nce.ca/conference). Although some government officials in Israel thought that this might be a good idea, it is yet to be implemented. Government might also support user trials that are developed with the active participation of facility managers, care staff, and residents (e.g., co-design). Such support would not only help in making facility managers aware of what new technologies could contribute to work in LTC facilities but would also increase the likelihood that there would be a good practical fit between needs and technology. Experience from Canadian trials where we deployed a socially assistive robot as an autonomous COVID screening robot in an LTC home showed that staff were accepting of the robot. They also became excellent advocates for the robot as they would discuss its potential benefits for the home, encouraging other staff to interact with the technology. Therefore, it is important for government to support the access and dissemination of new technology to LTCs from which they can benefit.[15] A great initial opportunity is to help fund in-house user studies with the technology so that staff can directly see first-hand the opportunities it provides.

 iii. *User-friendly technology*. New care-oriented technologies should be designed in a manner that would not only improve care for residents but would also be user-friendly for staff: relatively easy to operate, reduce workloads and unfulfilling mundane and repetitive tasks, and make technology culturally accommodating (e.g., apps that employ signs instead of English or robots that can speak multiple languages[18]—which could facilitate use by immigrant care workers whose command of the host country's language is limited). It was emphasized in the Canadian interviews that "*cultural adaptations and support, or even spiritual support using technology is very underutilized.*"

 iv. *Training workers*. The profile of workers in the LTC sector in Organisation for Economic Co-operation and Development (OECD) countries tends to be relatively lower-skilled, low-paid, and female, with an over-representation of immigrants. This general profile applies to both Canada and Israel.[19,20] The introduction of new technologies requires staff to operate these technologies and this in turn depends on formal/informal training. Given the little knowledge that facility managers possess regarding new technologies, it is unrealistic to expect that training would be always available in-house. Public support for training could help fill this gap[1] as government training programs, thanks to economies of scale, would be cost-effective as they serve numerous LTC facilities. Government support and provision of training could help solve the market

failure associated with the under-supply of training.[21] Moreover, the expected increase in worker productivity due to the application of new technologies could *potentially* increase worker pay.[22] However, government does little, in either country, to support on-the-job worker training in LTC settings with new technologies.

v. *Realign regulations and standards.* The use of new technologies in LTC settings requires that management and government consider not only the benefits but also possible harms, and regulate to limit the latter when necessary. However, regulation could create a series of bureaucratic hurdles for LTC managers. Indeed, this was recognized as a problem by government officials. One high-ranking official in Israel argued that the default option for government legal consuls who are consulted about new technologies is to say no and perhaps examine the case later. In fact, he would advise LTC managers who wish to adopt new technologies not to ask questions about whether it is permissible or not. In the Canadian interviews, it was emphasized that technology should be incorporated within the LTC standards, and both strategic policy and operational policy are needed. However, realigning the approval process cannot be tantamount to no regulation at all. In Israel, for example, one facility manager used a Temi robot to monitor workers with little regard for their privacy. Workers found this "big brother" type of technological surveillance disconcerting. The general imperative of upholding resident and worker dignity, privacy—and of course welfare—will require technology regulation.

Discussion and conclusions

Robots and assistive technologies could have helped considerably during the pandemic which was evidence in several instances. The lessons learned from our study suggest that policy-makers are generally aware that the introduction of assistive and robotic technologies could potentially help mitigate a plethora of problems that emerged due to the pandemic. However, the incorporation of new technologies during the pandemic under emergency conditions is especially complex. As a result, many LTC facilities postponed their introduction. Now that LTC facilities are coming to grips with the new post-pandemic "normal," it is imperative to identify what technologies are required in LTC facilities.

In general, the overall adoption of social robots for care of older adults has increased in the past several years.[15,23] Namely, in Japan, it has been shown that robot adoption has increased employment opportunities for flex-time care workers, helped to decrease turnover rates, and reduce burden of care.[24] However, in both Canada and Israel, we are still in the early stages of robot adoption, and researchers and governments need to support further robot integration studies to provide evidence for how such robots augment care and what their implications are on workload, productivity, and

wages in these countries. This is critical to long-term use and adoption of these technologies which is still lacking, as deployment studies have mainly been for separate local sites and for short durations.

Staff uptake of assistive robotic technology requires a clear introduction to the robot and demonstrations of its purpose and applications. To successfully integrate assistive robots, it is necessary for policy-makers to facilitate this process and for all stakeholders to account for caregivers' perspectives, engaging them in the design, deployment, and utilization of such robotic technologies in LTC homes. However, the adoption of new technologies in the LTC sector, tellingly in very different countries, is made difficult by several diverse factors, including low awareness, cost, the need for adapting to resident needs and facility conditions, care workers' acceptance, and existing infrastructure. Some of these problems can be resolved over time, but significant change requires policy.

As discussed by Dickson et al.,[4] in their analysis of the relevance of the LEADS framework to the pandemic crisis, health leadership should avoid reverting automatically back to previous practices from "normal" times, which are often flawed. Government health leadership that seeks system transformation should instead orient itself strategically to the future and support innovation: technological as well as organizational. Governments ought to act now as during pandemics/outbreaks the need is greatest, but the bandwidth to introduce technology is lowest. To address the broader critical issues faced by LTC homes, the integration of technology is important to strengthen the overall care sector. However, little has still been done in terms of policy and funding after the pandemic. Stakeholder actions, if well-planned, would not only improve care but could also advance the interests of workers. In fact, if the innovation process ignores worker needs and concerns, it is more likely than not to fail as technology is always only as good as the leaders who push for its adoption and those who actually use it daily.

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