Exploring the Co-design Process in the Creation of a Sensory Stimulation Assistive Technology

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The most recent report from the Canadian Institute for Health Information (2021a) estimated that in Canada there were 2,076 long-term care (LTC) facilities with 198,220 beds, and an average of twenty-nine beds per 100,000 individuals over the age of sixty-five. According to Statistics Canada (2016), approximately half of those residing in long term care have a diagnosis of dementia, the prevalence of which increases with age. As of 2024, 7.8 million individuals over the age of sixty-five live in Canada (Statistics Canada, 2024), and the Alzheimer's Society of Canada (2024) predicts that by 2030 there will be nearly one million individuals living with dementia. These projections raise serious concerns about the potential for dramatic increases in the number of individuals living in long-term care (LTC). In conjunction with these increases, there are the concerns that the COVID-19 pandemic brought to light. Within the first six months of the pandemic, residents in LTC accounted for 80% of the deaths that occurred, and by December 2021, residents accounted for 43% of the total deaths in Canada

from the illness (Canadian Institute for Health Information, 2021b; Canadian Institute for Health Information, 2021c). The high rates of infection placed considerable strain on the staff in facilities with dramatically increased absenteeism, accompanying understaffing, and demand for overtime hours. Unsurprisingly, the number of mental health issues reported by staff in LTC facilities rose considerably (Clarke, 2021) and residents reported they lacked choice in their lives and the care they received which contributed to increased distress and confusion (Davison, 2019). These concerns highlight the need for urgent action within LTC facilities, with assistive technology, defined as technology that helps improve functioning and enables health, well-being, inclusion, and participation in care (World Health Organization, 2024), often portrayed as a solution.

Non-pharmacological interventions, such as sensory therapy, are recognized as the optimal first line of intervention for LTC residents. Sensory therapies come in a variety of forms, and have been found to improve the physical, behavioral, and emotional functioning of individuals with cognitive impairment and dementia (Friedmann et al.,2014). The most common form of sensory therapy involves tapping and brushing which increases proprioception, the ability to perform daily functions, and enhances one's overall quality of life (Lancaster et al.,

2016). However, this form of therapy is usually therapist-directed based on protocol which does not take the individual needs and input from residents into account, and which involves direct physical contact between therapists and residents. To increase the autonomy of residents it is suggested that assistive technology (AT) might be implemented in the use of sensory therapies. AT, in the form of smart gadgets installed in home care settings, allows caregivers to monitor the recipient's actions, increasing their peace of mind and assisting in the completion of daily tasks while still ensuring the safety of their loved one (Arthanat et al., 2022). The use of this smart home automation also contributed to an increase in engagement in their care and increased autonomy for the care recipient (Arthanat et al., 2022). Just as AT can be implemented in private homes, it can also play a role in LTC, contributing to a reduction in workload and providing a sense of safety for residents and staff (Dorsten et al.,2009). These benefits allow for autonomy for residents and reduced burnout for staff which is a critical outcome of a person-centered approach to care.

The World Health Organization (Bennett et al., 2015) recommends that best practice for care includes a focus on delivering care to individuals while accounting for the needs identified by the residents, their families, and trusted others. A person-centered care plan (PCC) allows staff to focus on the

needs of the individual, promoting care that reflects the values, preferences, and functionality of residents which fosters shared decision-making between residents and staff (Howard et al., 2021; Kim, D & Kim, M, 2023). PCC models such as enhanced care plans increase communication between residents and staff and increase the residents' perceptions of thriving while living in LTC (Guney and Kardag, 2023; Baxter et al., 2020). The impact on resident well-being shows the benefits of a more person-centered approach to resident care. While the person-centered approach cannot be implemented for every resident every time, this research lends weight to the argument that when it can be implemented it should be.

With the benefits of a PCC model of care being evident, it is beneficial to the process of designing new assistive technology, that all involved in its use provide input on how best to implement it. As Such, the co-design process is intended to create an understanding of the experiences and needs of all users in the development of technology, from direct end-users, to upper management, to front-line staff (Chinaleong-Brooks, 2020). In the context of sensory therapy, Lima (2024) found that naturalistic observation and casual conversation with individuals with cognitive impairment allowed for a natural flow of information that contributed to designing sensory and cognitive stimulation games that suited individual needs. Likewise,

Wright et al., (2023) used the co-design process in an acute psychiatric unit to engage with care workers, nurses, and doctors to identify important impacts on the use of sensory therapy, facilitating preparation for a change in sensory practice. These two studies show the usefulness of the co-design process and the varying stakeholder groups that can be identified to participate in the implementation of designs.

The Present Study

To increase the autonomy of residents it may be desirable to enhance person-centered care in the context of sensory therapy through the co-design of AT solutions. As a potential solution, an occupational therapist in Alberta is designing a self-administered sensory stimulation tool. This technology will prompt residents using a visual cue from a projector to engage in sensory therapy with a sensory tool of their choosing. This visual cue indicates which area of the arms or legs to begin with,and moves through the body areas until the completion of the therapy session. This investigation engaged in a comprehensive co-design process to further the design and implementation of this new sensory stimulation assistive technology. By exploring the perspectives of varied stakeholder groups and collecting shared and unique perspectives this study will engage in an early-stage co-design process to contribute to

the iterative process of co-design, which will allow for progress toward the development and implementation of a field-ready prototype of this AT.

Method

This study used a convenience sample of participants (N = 14), including administrative and managerial staff at Bethany CollegeSide (n = 5), residents at Bethany CollegeSide (n = 6), an occupational therapist (n = 1), and two occupational and physiotherapy assistant students from Red Deer Polytechnic (n = 2). Recruitment for all participants included posters and communication with the coordinator at Bethany CollegeSide, and the occupational and physiotherapy assistant instructor at Red Deer Polytechnic. No incentive was offered for participation in this study. The inclusion criteria were the same for all staff in that they must hold a paid position with Bethany CollegeSide. The occupational therapist was required to be working within the field as an occupational therapistOccupational Therapy students were required to be enrolled in the occupational therapy program at Red Deer Polytechnic as either first- or second-year students. Finally, residents must reside at Bethany CollegeSide full time. This study received approval and followed the ethical guidelines of the Red Deer Polytechnic Research Ethics Board.

Materials

The materials in this study included a demographic questionnaire that outlined their gender, and years working/ living in LTC,a set of four pre-recorded demonstration videos (the product pitch, a sensory education video,the user interface for therapists and rehab staff, the resident user journey). Two digital recording devices were used to record the data. An open-ended focus group moderator guide was used to ensure the flow of the focus groups was maintained. Questions included in the sessions for staff, students, and occupational therapists were as follows: 1. What do you see as the biggest challenge to effective care in LTC? 2. What role, if any does technology play in helping to address these challenges? 3. How would you describe the pros and cons of assistive technology? After watching the demonstration videos the participants were asked: 4. Having seen the demonstration, what are your general impressions of this particular technology?; 5. What are your views on the potential usefulness of this technology?; 6. What problems do you see with this technology?; 7. What advice/ suggestions do you have for the developer of this technology?; 8. Do you have any final thoughts or anything else to add? These questions were modified slightly for enhanced readability with resident participants.

Procedure

Due to scheduling conflicts, only the administrative/managerial group and the resident group were completed using focus groups. The occupational therapist and the two occupational and physiotherapy assistant students took part in individual interviews with the student researcher using the same procedure. Participants provided written or verbal informed consent. All participants were asked the first three questions for their specified group and viewed a selection of demonstration videos. The administrative/managerial group and the occupational and physiotherapy assistant students viewed videos, 1,2, & 4, the Occupational therapist, viewed videos 1,2,3, & 4, and the residents viewed only video 4. The selections of the videos were based on the scope of the participant's employment or education as well as relevance to residents. Each group was asked five follow-up questions regarding the technology discussed in the videos. All interviews and focus groups lasted between twenty and forty-five minutes. This study used thematic analysis, a qualitative method used for identifying, analyzing, and reporting themes within the data allowing for the organization and description of rich data, placing data from all participants into similar themes (Braun & Clarke, 2006). In this study, once all interviews were completed the data was manually transcribed, anonymized, coded, and

themed by the student researcher and then coded by a second independent coder.

Results

The demographic questionnaires were reviewed the participants self-identified as female (n = 7) and male (n = 7). Resident participants stated they have lived in long-term care for between 1.5 – 12 years. Administrative and managerial staff and the occupational therapist worked within the long-term care for 9-25 years. Finally, the student participants were both first-year students. After coding, three key themes were identified reflecting both shared and unique experiences/perceptions. The first theme, Capacity Concerns and the Ambivalent Advantage of Technology occurred in four of the five sessions and encompassed the capacity issue in long-term care. The use of technology can contribute to solving the capacity issue however, implementation of such technology comes with the need for more financial resources, and staffing resources "Current technology resource supports to implement and identify appropriate technology creates more problems in LTC, as we adopt technology when it doesn't have a broader technological solution to address the issue in the workforce." Cross et al., (2024) found that without the appropriate training and funding, staff were hesitant to engage in the use of AT even if it was a

benefit to the residents. One participant's main concern revolved around the space required for this specific technology. "You can't have this in patient rooms, so you would need a separate room, and they might not have the rooms available. They'd have to get rid of something and then they'll need something else." While there is concern regarding workforce capacity and space, care that is facilitated using technology helps residents to be able to go about their daily activities. "If we don't get the care, we're not able to go on with our day". Of particular interest in this theme is that the staff group and the occupational therapist were concerned about financial and workforce capacity whereas, the students were concerned about the physical space available to support the implementation of new technologies. This theme accentuates the need for a balance of staff workload and funding as well as space that facilitates new opportunities without taking away from another necessary activity.

While capacity issues are a major focus within LTC, another vital concern involves the quality of resident care. The second theme identified was the Impact on Quality Care. This theme encompasses the importance of high quality of life for residents, and the sorts of staff-resident interactions that best facilitate this. This theme occurred in four of the five sessions. Of importance is ensuring that any new technology is actively contributing in a meaningful way to effective care. In one case a

participant explained the concern that arises when introduced technological changes do not integrate effectively with existing equipment/practices “I spent two hours yesterday trying to find a personal directive for a guy who needed a bed on Monday, but I can’t get it, because I’m not on that platform. I called placement and they didn’t have it either, so to me that is a technological issue that’s really interrupting service.” In this case, the use of technology interrupted the participant's ability to provide needed care to other residents and could have delayed the intake of the resident needing a bed. One of the student participants explained the concern of loss of valuable skills for staff “…you could have a chance of getting less experienced personnel right, people are going to be using the equipment more, so they lose that skill that they have.” One group difference regarding this theme was that while staff mentioned the potential added burden to staff of new technology students were more concerned about how the eased burden resulting from new technologies could adversely impact skill development/maintenance. This theme illustrates the varied ways ways new technology could impact the quality of care that residents receive and highlights the challenge of balancing advantages and limitations.

When implementing new technology within any work or home setting finding the right fit for the right population is key. In a LTC setting the technology working for the right population

is even more important as the population for which this technology is being implemented are in many ways vulnerable. As such the third and final theme identified was Person-Environment Fit. This theme was identified in every session conducted and was a concern for all participants. The original intent of the developer of this technology was for this technology to be used by residents with dementia. According to one participant, however, “When I look at the residents that we have in our dementia units, I don’t think that they would be able to figure this out. We would be spending more time assisting them and helping to explain how it works than we would put into a regular therapy program for them.” The concern in this theme revolves around the requirements of using and benefitting from the technology relative to resident interest and capability. There was concern among several participants that this technology, though promising, was not a good fit with the target population. One participant from the staff group expressed that changing the resident population would be beneficial “I feel like more for a young adult population maybe would be cool.” The occupational therapist suggested that if the developer wanted to use it for those with cognitive impairment it might be best implemented with, “someone who has super mild cognitive impairment or brain injury”. The staff group further suggested that“if it (the sensory intervention) could be done as a group that

supports their time (it) may be more effective. Then it might increase cueing from other people and more opportunities for sensory." This opportunity for interaction between residents encompasses the overall feeling regarding this technology, it can be useful, in the right context, with the right staff training, and the right resident population.

Discussion

The benefits of assistive technology range from reducing staff workload to increasing the feeling of autonomy for residents. The results of this study show the barriers and benefits associated with not only the use of technology within LTC but also the specific benefits and barriers that can be found using this assistive technology. The first theme identified was centered largely around the capacity issues within LTC, with the staffing crisis and funding for new technologies to help residents and lessen staff workload being a highly recognized issue. The evident risk for care homes is loss of funding, which impacts staff, residents and their family members. Brassolotto et al., (2020) emphasize that in Alberta the long-term care homes most affected by funding cuts are the ones within rural areas. As such providing therapies and protocols that are easily accessible to all facilities and family members could allow for the safeguarding of forms of therapy. Financial restraints and lack of

accountability for care leave the staff feeling constrained and powerless against the limitations that occur (Brassolotto et al., 2020). These constraints felt by the staff will then compound on top of the already overwhelming work overload leading to more staff turnover and increasing the capacity issue within the facility.

The use of technology is meant to assist individuals with conducting certain aspects of their care independently. Thus, residents' perception of their ability to use the technology is integral to its function in LTC. Of particular interest to this study is healthcare technology self-efficacy, an individual's perception of their ability to use healthcare technology effectively, which includes their emotional state regarding their healthcare and their perception of these technologies (Rahman et al., 2016). Concerning using healthcare technologies, Graat et al., (2025) found that confidence in the ability to use technology plays a vital role in participant engagement suggesting that when individuals lack the necessary self-efficacy, they have more difficulty engaging. Specifically, in the case of residents with more severe cognitive impairment, it would be vital to ensure they felt strong self-efficacy regarding their ability to use technology.

Conclusion

This study explored the use of the co-design model in the creation of a sensory stimulation assistive technology tool. While there were concerns regarding the target population, the overall attitude towards this technology was positive. A vital outcome of this study was the input provided by the multiple stakeholders involved. While co-design typically involves input from developers and end users (Chinaleong-Brooks, 2020) this study emphasizes that input from other key stakeholder groups also has considerable value. This study accentuated the need to gain input from various perspectives to ensure that the needs of all those impacted, from organizational staff to end users, have a say in the design of important technology.

There were some limitations within this study. Sample size was smaller than anticipated. The original intent was to have multiple members of each stakeholder group participate in focus groups. This was not possible, for front line staff and student groups, however, a reflection of staffing capacity issues within long-term care, and student workloads and time constraints. Nevertheless, there was representation from multiple stakeholder groups.. providing valuable information to the developer as they move toward a prototype ready technology.

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