

Infrastructure to support the Canada Research Chair in Senior Care

The CRC research program in senior care responds to the urgent demand for personalized care in dementia care by taking action to innovate care in Long-Term Care (LTC) homes and hospitals. The requested infrastructure consists of two groups of items essential to the program: (a) materials and equipment for developing the proposed digital intervention **WhatMatters** and (b) equipping the IDEA lab (Innovation in DEmentia and Aging) for training, collaboration, research work and knowledge translation activities. As discussed in the accompanying CRC application and Figure 1, Dr. Hung’s proposed research involves developing WhatMatters, a digital program, which creates accessible mechanisms for families to meaningfully connect with people with dementia in hospitals and LTC through an assistive robot and a mobile app. Through WhatMatters, multimedia resources (e.g., videos, photos) will be projected onto walls to provide a rich virtual reality (VR) experience without VR goggle, which can be difficult for older people with dementia and frailty to wear. From her experience working at the frontline at Vancouver General Hospital during the first two months of the COVID-19 outbreak, Dr. Hung witnessed first-hand the effects of isolation, such as older patients refusing to eat because their families were not able to visit. In one example, when a tablet was introduced to help an older patient talk with her son every morning, she started to eat again. However, the routine use of tablets is not always possible due to staffing shortages and busy workloads, as older patients with frailty and dementia rely on staff assistance to access such technology. The proposed research will help address this issue through a robotic-assisted solution.

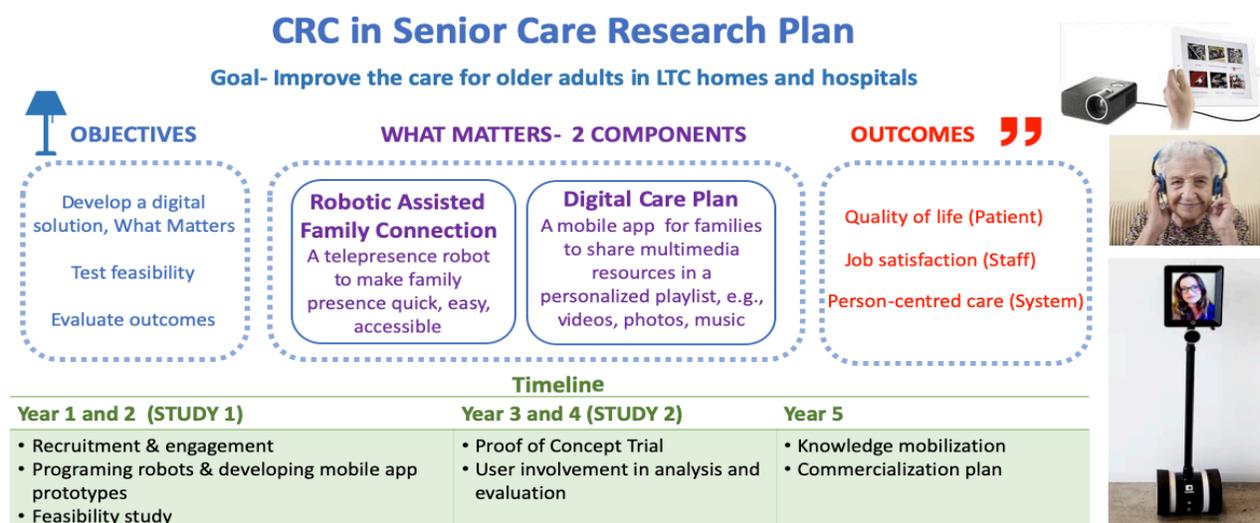


Figure 1: WhatMatters with two arms of support: an assistive robot and a digital care plan

The requested infrastructure will support research to test if robotic assistance can alleviate social isolation and improve quality of life for older people with dementia in hospitals and LTC. By configuring existing commercially available technologies, it will be possible to *rapidly* introduce this affordable and essential person-centered care solution into healthcare practice, especially critical during the ongoing pandemic. The outcome variables are quality of life among patients and residents, job satisfaction of staff, and person-centred culture in the care system.

INFRASTRUCTURE DESCRIPTION AND JUSTIFICATION**a. Materials and equipment for developing the WhatMatters solution**

- **Item 1: Double Robot (10 counts) \$90,000** Self-driving telepresence robot, Double 3 by Double Robotics, adjustable height 47"-60", 9.7" LCD, 6 microphones and amplified speaker

It can be difficult for an older person with frailty and dementia to ask staff to set up a laptop for a family video call. WhatMatters 'changes the game' for virtual connections by using robotic assistance. The telepresence robot, called Double (see Figure 1), will be used to develop WhatMatters' first arm of support: customized robotic-assisted family connection for patients in hospitals and residents of LTC homes. Double version3 was chosen because it has superior features compared to other telepresence robots in the market; for example, it is more affordable than the 'Giraff' robot, which costs twice as much and requires a monthly fee. Double is easy and safe to use and has been used reliably for eight years to assist employees in technology companies to work remotely. Double also allows customized applications to be added to assist patients/ residents to connect with family and play multimedia resources, such as videos and music. This robot is capable of driving autonomously, being guided by multiple embodied sensors to avoid obstacles in the environment. In this research, customized mapping and path planning will be programmed to allow efficient movement between target destinations and the charging dock. For example, the robot can be programmed to go to a patient's room every morning or evening. The feasibility study will explore enablers and barriers to implementation and evaluate for the usefulness of the robot in care settings. For example, when a patient/ resident is in quarantine, it can mean prolonged isolation from social interaction, which can significantly negatively impact mental health and well-being, and cause severe worries and guilt for families. Even beyond the pandemic, the programmed robot is anticipated to strengthen social connection for families by giving them a social presence where they cannot be there physically in person. As a research tool, the robot will be needed to provide remote training and ad hoc support for stakeholders (e.g., nurses and care workers) in research. Importantly, Double is its own contingency plan, which allows the research to continue even if the research team is restricted from entering care settings due to infection prevention and outbreaks in future waves of COVID-19. The robots will allow the team to continue with research remotely with the IDEA lab. A total of 10 robots are needed for virtual research activities: 2 for the IDEA lab, 2 at each of the 4 research sites, Vancouver General Hospital, University Hospital of Northern BC, Villa Cathay in Vancouver and Parkview in Prince George.

- **Item 2: Laser Projector (10 counts) \$120,000** NP-P506QL model 4K Laser projectors by Matrix Video Communications Corp (MVCQ), 5,000 Lumens, 5-year warranty

Recent research in Australia found that although older people with dementia in LTC can benefit from VR experiences, many are not willing to wear the VR goggles.¹ Therefore, projecting family videos/ images can provide an alternate rich and immersive shared VR experience without the need for goggles. Laser projectors will be used to deliver family videos through a mobile app (WhatMatters' second arm of support) to provide a shared VR experience for patients/ residents in the care environment. This projector model is necessary for the research because it can deliver high-quality 3D images, required to test the shared VR idea in hospitals and LTC by illuminating walls and ceilings with videos and visual imagery. A total of 10 are requested - two for the IDEA lab for program development and two at each clinical site (2 hospitals and 2 LTC). To create layers of images for shared VR experiences, two projectors are used together. Projectors also make it

possible to live stream family gatherings to the care environment in real-time (e.g., a grandchild's birthday party).

- **Item 3. Tablets (25 counts) \$45,000 12.9" iPad Pro, 512GB, A12Z Bionic chip**

The iPads with an A12Z Bionic chip, 8-core graphics engine, 4K video, 60 fps (Wide); 60 fps (Ultra-Wide) cameras will be used to develop and test a mobile app, which can function like a digital care plan to organize multimedia files in playlists and stream digital content. The tablets will be critical for conducting research with stakeholders (patients and residents, families, and staff) at multiple research sites (urban and rural). The tablets are necessary for the involvement of older people (patient and family partners) in research to co-design the mobile app features and interface. One iPad will be used in the IDEA lab to conduct research for app design. Each of the four clinical sites needs six iPads to test individual and small group programs. In the evaluation research, patients and residents can be in their own room but still connect virtually with others in an activity program (e.g. a virtual zoo visit). Apple IOS devices are needed for the research program because they are compatible with the Double robot, allow multimedia data synchronization for digital files created in multiple devices, and, importantly for this work, have a user-friendly interface to support ease of use, which is critical in patient-oriented research to co-design with users, frontline staff and older people with dementia. The iPad Pro 512 GB has been used in Dr. Hung's research in the iPad study for the past four years, and it has been reliable.

- **Item 4. Sound off system with microphone and headphones (4 counts) \$20,000**

The Sound off system (also called silent disco headphones) by Sound Off™ Experience is needed for the WhatMatters program; each unit is comprised of a 500M stationary transmitter, a 300M Bluetooth transmitter, a facilitated headset microphone, 40 noise-cancelling headphones, a Yamaha MG06X Mixer and cables. The headphones will be used to compensate for age-related and dementia-associated sensory impairment. The facilitated microphone makes sound loud and clear for the patients and residents to hear through the headphones even if the staff (speaker) is wearing a mask. The noise-cancelling feature reduces environmental distraction. Dr. Hung has been using the silent disco system at VGH for two years (including during the time of COVID-19 pandemic); the system is easy to use, reliable, effective and well accepted by staff and patients. In an interview after a meditation program, an older patient with dementia commented, "the headphones helped me feel rejuvenated, it was an escape from the stress in this environment (noise in the hospital unit)".²

- **Item 5. Laptop (10 counts) \$25,000, MacBook Pro 13" 1.4 GHz 8-core i5 processor, 8GB, 4-Year AppleCare**

The laptops will be used for programming the robot and developing the mobile app. The set of laptops will be utilized as mobile research tools as well as for qualitative and quantitative data analysis. The MacBook Pro is sufficiently powerful to handle multimedia data. The research will need frequent and quick synchronization and transfer of large multimedia files between devices by airdrop and iCloud. These features are critical for research efficiency.

b. Equipping the Chair's research lab, IDEA (Innovation in DEmentia and Aging)

- **Item 6. Computer (4 counts) \$12,500, iMac 27" 3.1 GHz 8-core i5 processor, 1TB, 4-Year AppleCare**

This research program relies on high-quality technology equipment and digital resources for research infrastructure. To enable the CRC program, Dr. Hung and her trainees require access to powerful computers for the work of digital graphic design and handling other various formats of

multimedia files such as videos, music, and images. The iMac computers requested have AMD's Radeon Pro 5000 Series Graphics, offering superior performance to other platforms. The AppleCare will cover maintenance and warranty if any problems arise. The iMac is a powerful all-in-one tool that is critical for producing high-quality research materials in engaging and user-friendly formats (e.g., graphics and videos) for students and members in the research team and advisory panel (i.e., patient and family partners, clinicians, and community organizations such as Alzheimer Society). The IDEA lab requires four iMac computers to function as the home for a virtual hub to collaborate with partners in research and host knowledge translation events, research days, and hackathons. Investing in the infrastructure for the IDEA lab will support a world-class training environment for HQP. In the climate of the COVID-19 pandemic and post-pandemic, a virtual hub is vital for engaging patient and family partners, healthcare practitioners across organizations, leaders of community partners, as well as researchers from universities across Canada and other countries internationally. The lab will be used to support virtual collaboration with Dr. Ruth Bartlett (University of Oslo in Norway) who studies everyday technology use among people with dementia, Dr. Brendan McCormack (Queen Margaret University in Edinburgh), who studies technology in dementia care, Dr. Mei Lan Fang (the University of Dundee in Scotland), who studies the digital divide and health inequalities, and Dr. Ying-Ling Jao (Penn State University in United State), who studies apathy in LTC care environments. Dr. Hung will invite international scholars to interact with UBC faculty and students by events such as virtual research roundtables, webinars, and virtual conferences.

Existing Infrastructure. All of the equipment requested is required for the successful completion of Dr. Hung's proposed CRC research program in senior care. Currently, there is no dedicated research laboratory at UBC to meet the growing demand for technology-based solutions for senior care. Although some of the requested items are available within UBC but they are not accessible to allow Dr. Hung to have dedicated use for her research. Dr. Hung needs the largest size of iPad to work with older people to accommodate aging eyes. The headphones are necessary to compensate hearing impairment. There is currently no existing optimized technology hub to support patient partners and clinician engagement for the co-creation of much-needed solutions for dementia and aged care. The IDEA lab will become a unique resource at UBC and provide a useful model for other patient-oriented research teams to increase their remote collaboration capacity.

BENEFITS TO CANADIANS

Potential socio-economic benefits

There are currently approximately 50 million people living with Alzheimer's disease and other dementias worldwide, with almost 10 million new cases each year. In Canada, the combined health care system and out-of-pocket caregiver costs amounted to \$10.4 billion in 2016³, and this figure is expected to increase to \$16.6 billion by 2031. The double pandemic of dementia and COVID-19 has made innovation to support dementia care an urgent demand in Canada and worldwide. This program's research results will offer decision-makers high-quality, real-time, actionable evidence to further test the effectiveness of virtual care for a person-centered healthcare system in LTC and hospitals and prepare for possible future waves of pandemics. Social isolation was a significant issue for older people with dementia prior to the pandemic and will continue to be a problem well into and beyond the COVID-19 crisis. Findings will potentially revolutionize the care for older people in LTC by configuring existing commercially

available technologies. It is anticipated that it will be possible to rapidly introduce this affordable person-centered solution into healthcare practice. Because it is important to respect individual preferences and values, the design and implementation of technology must be personalized, relevant, meaningful and person-centered for success and sustained use. The baby boomer generation is already familiar with digital technology such as smartphones, iPads, and music headphones. As we move into the future, the proposed research is timely to address older people's needs in care settings.

The requested infrastructure will make virtual care research possible for older people in care settings aiming to improve quality of life and mitigate social isolation. Families are essential partners in care, and they need to remain connected with their loved ones in care settings during and post-pandemic times. Digital music, photos, and images can be useful resources for care providers, as the shared virtual experience can stimulate memories for older people, spark conversations, promote emotional connection and relationships. With the growing demand for senior care, recruiting, retaining and sustaining a workforce is vitally important. WhatMatters highlights people's preferences, personal strengths, and family resources, and engages the family in care planning as partners by sharing comforting resources. This work will contribute to shifting the task-focused culture in care settings to person and family-centered. Findings will produce useful knowledge to benefit patients and residents and give much-needed support to staff by equipping them with easy-to-use resources to deliver person-centered care efficiently and effectively. The expected outcomes include increased job satisfaction of staff and support for better person-centered transition from hospital to care homes, as the program's virtual nature makes it easy to follow patients across care settings.

Better training and improved skills for excellent trainees/students

The ability to attract scholars from such a wide variety of fields is an asset for any multidisciplinary initiative. Dr. Hung has a strong background in working with scholars in diverse fields of inquiry. For example, she has supervised and mentored physicians, nurses and occupational therapists in the social robot project⁴ and the iPad project.⁵ The IDEA lab will provide a unique training ground for students across disciplines with the requested equipment, including the self-driving telepresence robot. The multidisciplinary nature of the subjects researched, and the equipment, technology and related infrastructure requested to conduct the field research will attract students and trainees from varied backgrounds, including nursing, medicine, computer science, psychology, and engineering. The program will directly support at least ten trainees in Nursing, Medicine and Engineering, including 2 Ph.D. and 8 Master's students, who will be fully integrated into the proposed research activities, including producing outputs such as academic publications and practice reports as well as presenting their work via multimedia platforms. There will also be training opportunities to support undergraduate nursing students for research and informatics competencies in the program. Students will learn about co-design methods for the development of technology-enabled solutions and will work with stakeholders to co-implement and co-evaluate feasibility for the technology. Trainees will become skilled in navigating complex environments by working with clinical and technical experts, as well as patient partners and community organization (e.g., Alzheimer Society). Dr. Hung's program of research will provide students the opportunity to build their technical skills while also learning and practicing the range of professional skills required to succeed in health technology innovation. For example, students will gain knowledge translation aptitudes for

bridging clinical and digital divides. Likewise, graduates will have acquired project management skills that consider the technological feasibility, clinical constraints, and community partner timelines necessary for successful completion. Overall, this fluency in both the clinical and digital worlds will serve graduates well whatever future directions they pursue whether in practice, industry, or academia. The research program will equip students to be at forefront of health technology innovation as entrepreneurs, early start-up employees, and industry leaders in digital health for senior care.

Knowledge mobilization and partnership with users

Knowledge mobilization and communication of results are key in this research. This involves a multi-tiered approach that will emphasize scholarly and practical outputs. A central focus will be on publishing in high-quality and high-impact scientific journals (e.g., BMJ and Gerontologist) and targeted professional practice journals (e.g., International Journal of Older People Nursing, Journal of Rehabilitative and Assistive Technologies Engineering) to maximize reach (6-10 articles per year). Trainees will have opportunities to co-author for publication. Findings will be presented at professional and academic conferences, such as Alzheimer Europe, Gerontological Society of America (6-10 per year), where trainees will also have opportunities to present. These experiences will allow for networking opportunities with other researchers, practitioners, funding agencies and policymakers. A public webpage and social media platforms (e.g., Facebook, Twitter, YouTube videos, podcasts, infographics) will be utilized to make the information more accessible to the LTC leaders, general public and community members. Practical toolkits will be developed to support implementation. The mobile app will be made available for the public to download for widespread use. Dr. Hung's research has attracted ongoing media attention over the past few years; engaging with broader media outlets will also be an important responsibility due to the significance of popular media and public engagement. Newspapers, radio, television and online media will be targeted through the distribution of press releases containing lay summaries of research findings. Findings from this innovative program will contribute to advancing the science of knowledge translation by demonstrating how knowledge users (patient and family partners and frontline clinicians) can work together with academic researchers and students to co-design a novel intervention for person-centered dementia care. While there have been prior and current training programs focused on bridging engineering to generate health technology solutions (e.g., UBC Engineers in Scrubs), this is the first to introduce the co-creation structure and a truly interdisciplinary team to engage in co-design with users (patient partners, families, nurses and care workers) in the hospitals and LTC. Bringing together engineers, healthcare clinical experts, and patient partners in a team-based experiential training program will produce more useful and usable solutions. The strategies to overcome barriers to rapid technology adaption in care settings will be useful evidence for researchers, practitioners, and healthcare decision-makers to inform change.

References. [1]. Moyle W, Jones C. Effectiveness of a Virtual Reality Forest on People with Dementia: A Mixed Methods Pilot Study. *Gerontologist*. 2018;58(3):478-487. [2]. Hung L, Dahl K, Poljak L, Feasibility of applying silent headphone technology among older adults with dementia. *Sage Open Nursing*. 2020. [3]. Alzheimer Society of Canada, About dementia. <https://alzheimer.ca/en/Home/About-dementia>. [4]. Hung L et al. The benefits of and barriers to using a social robot PARO. *BMC Geriatr*. 2019;19(1):232. [5]. Hung L et al. Use of touch screen tablets to support social connections among people with dementia. *BMJ Open*. 2019;9(11).