Project Title: CogWorks: Co-creating sustainable workspaces for aging workforces

Project Leads: Arlene Astell (KITE Toronto Rehab – UHN), Jen Boger (University of Waterloo), Josephine McMurray (Wilfrid Laurier University)

While the United Nations identified "full and productive employment and decent work for all" as one of its 2015 Global Goals for Sustainable Development, there has been limited progress to support employees who develop Mild Cognitive Impairment or early-stage dementia (MCI/Dem). Workplaces currently approach the situation from a 'limitations' perspective, which often leaves employees with MCI/Dem without the option to keep working. The CogWorks project will create systemic models and explore novel business paradigms to flip the current limitations archetype to one of possibilities for employees and employers in Canada. This will include identifying facilitators and barriers to sustaining employees with MCI/Dem as well as systemic changes needed for accommodations that are in line with existing disability legislation. CogWorks will collaborate with employers, employees, healthcare, and policy-makers to explore ways that workspaces could become sustainable for people with MCI/Dem. We will create systemic models of the landscape to enable the mapping of proposed changes at levels ranging from governmental to individual. We will explore motivators for employers, including social return on investment, and synthesise this with the aspirations of people with MCI/Dem in relation to staying at work or transitioning out. We will also examine the potential, as well as the challenges, of developing and implementing supporting technologies into sustainable workspaces for employees with MCI/Dem. The outcomes of CogWorks will be threefold: 1. A model of current workplaces for MCI and early dementia; 2. A policy agenda addressing current gaps and drivers for developing sustainable workspaces; and 3. Requirements for existing and new technology innovations to support sustainable workspaces. Products will include CogWorks website and resources including organizational case studies, sustainability models to demonstrate economic and social return on investment, prioritized product requirements, and a national support network of organizations with sustainable workspaces.

Project Title: Evaluating and scaling up MOvIT+

Project Lead: Claudine Auger (Université de Montréal)

Our proposal will scale up and evaluate MOvIT+ (Mobility Outcomes via Information Technology), a web-based service that is unique and novel in Canada. Technology: MOvIT+ brings together multiple digital technologies to enhance the follow-up of older adults and caregivers who use mobility assistive technologies (ATs): i) an Internet-based system for registration, telemonitoring and teletraining after prescription, ii) a sensor-based intelligent positioning system to monitor the actual usage of the mobility device and provide feedback based on clinical recommendations, iii) a website that regroups training resources for mobility AT users. The current proposal will be adding iv) a dashboard for decision-makers at the local and provincial levels, vi) a 3D mapping application of the user environment, vii) a Cloud infrastructure to manage the anonymized sensor-based data generated by the fleet of instrumented devices. Services: MOvIT+ helps structure the follow-up services that are otherwise not available in the health-care system. It offers training tools based on the monitoring results and alerts rehabilitation professionals only if remote counselling of the user/caregiver is needed. Policy & Practices: A large-scale implementation protocol will be co-developed with participating sites and our advisory committee for multiple target audiences: AT users, caregivers, clinical teams, community partners, funding agencies, and technological partners. The Quebec Ministry of Health supports our proposal as this will be the first Canadian initiative providing large-scale ongoing monitoring of the clinical impacts of mobility AT funding programs. We are partnering with CEFRIO, a non-profit organization that specializes in the implementation of innovations in organizations, to study and support our implementation process. This will broaden MOvIT+ (refinement and validation of current components, integration of new digital components, specification requirements for scaling up to new sites) and scale it up for dissemination in 7 Canadian sites, reaching >1000 AT users.

Project Title: Monitoring My Mobility (M3): A mobility self-monitoring tool for older adults and their caregivers

Project Leads: Marla Beauchamp, Brenda Vrkljan, Qiyin Fang, Paul McNicholas, Bruce Newbold, Paula Gardner, Ayse Kuspinar, Julie Richardson, Manaf Zargoush, Parminder Raina (McMaster University)

Problem statement: Problems with everyday mobility, such as walking and driving, are common in older adulthood and can negatively impact health and social functioning. Although mobility is a critical indicator of health, older adults are not typically involved in monitoring or assessing their own mobility. In our stakeholder consultations, older adults expressed a clear interest in self-monitoring their mobility as part of their health. However, there are currently no wearable technologies that comprehensively monitor mobility and that are valid for predicting important health outcomes.

Research purpose: This research will use the latest advancements in wearable technology to understand how mobility changes over time in older adulthood, and how this affects important health outcomes. This project will develop a wearable technology tool for mobility self-monitoring by older adults and their caregivers.

Research approach: We will start by customizing a wristband device that can monitor the many ways in which older people move in their home and community. We will then recruit 1,500 older adults to wear the wristbands for 5-day intervals every 3 months for 2 years. Participants will also attend in-person visits and receive phone calls to collect their health information every 3 months. We will use machine learning to analyze the collected data to understand how mobility changes over time and affects health. Finally, we will design, with input from older adults and caregivers, a mobility self-monitoring tool to track and manage older people's mobility and health.

Anticipated impact: A self-monitoring tool that is both comprehensive, yet sensitive enough to capture subtle changes in a person's mobility could alert older adults and their caregivers to an impending change in their mobility and health. This technology will be a "game changer" for enabling older adults and their caregivers to self-manage their mobility as part of their health.

AGE-WELL CRP Catalyst Projects

Project Title: Ubiquitous cognitive assessment in the aging population

Project Leads: Mark Chignell (University of Toronto), J Bruce Morton (Western University)

Cognitive status affects health outcomes and functional independence, but cognitive assessments of older people are infrequent. We have no standard tools for assessing the full range of cognitive abilities on a continuing basis. The risk of cognitive decline increases rapidly with age and we need to monitor cognitive health more closely, collecting data on how different cognitive abilities change with age. We can't manage what we don't measure, and some functional declines may be preventable. Detailed cognitive assessment can inform the design of interventions to improve or maintain cognitive health, and screen out interventions that are harmful to cognitive health.

We propose to develop scientifically validated game-based assessment tools that will allow people over the age of 65 to be tested across a battery of cognitive abilities relevant to functional independence, and general well-being. Our research will determine how this can be done, at low cost, with a suite of serious games that each target a different aspect of cognitive functioning and that are validated against current cognitive tests. Magnetic resonance imaging will be used to confirm that our games engage executive brain networks as expected. Our cognitive assessment devices will be widely available and will collect clinical results that demonstrate the feasibility of our approach collecting cognitive aging data for a normative repository that can be used to assess cognitive impairment and the onset of dementia far more precisely than is currently possible.

Tools for acquiring cognitively- and neurophysiologically-validated measures of cognitive ability will facilitate basic aging research and improve the standard of care for Canada's aging population. Detailed tracking of cognitive status, as people age, will allow clinicians, scientists, and decision-makers to incorporate the impact on brain and cognition into evaluations of interventions.

Project Title: Social enterprise as a sustainable solution to promote the employment and digital inclusion of older adults with cognitive disabilities

Project Lead: Virginie Cobigo (Children's Hospital of Eastern Ontario)

The solution described in this proposal is a social enterprise (SE) that promotes user-centred and accessible technology development, by supporting the active participation of older adults with cognitive disabilities (CD) in technology research and development (R&D) processes. Our SE addresses two of AGE-WELL's challenge areas: Financial Wellness and Employment, and Autonomy and Independence. The employment rates of older adults with cognitive disabilities remain extremely low, specifically in the technology industry, despite a general increase in the employment of older adults. This exclusion from the technology industry has serious consequences on the lives of older adults with CD, such as financial difficulties, social exclusion and low self-esteem. Moreover, emerging technologies such as mobile applications and social robots offer exciting new opportunities for promoting their autonomy, independence and social inclusion. However, many older adults with CD are unable to fully benefit from technological advances because technologies are not accessible to them, they are often vulnerable to privacy threats, and their use of technology is limited or unduly influenced by caregivers and professionals who may limit access due to safety concerns.

This project aims to (1) document the steps and best practices for creating a sustainable SE aiming to offer employment to older adults with CD and to decrease their digital exclusion, and (2) evaluate the impact of the SE for various groups of stakeholders. We will apply inclusive research methods and a continuous quality improvement approach. Findings will inform the growth of the proposed SE and its replication.

Our SE will provide older adults with CD with technology-related skill-development and employment opportunities as associate consultants in technology R&D projects. In addition, the enterprise will accelerate the delivery of ethically sound technologies for older adults with CD and their caregivers.

Project Title: Precision mental health: A stakeholder-informed, Big Data approach to psychological wellbeing

Project Leads: Theodore Cosco (Simon Fraser University), Martin Ester (Simon Fraser University)

Feeling down or worried happens to everyone, but for some people these feelings are very strong, long-lasting, and can be damaging to them and their families. Mental illnesses, such as depression or anxiety, may include feelings of hopelessness, helplessness, guilt, or even suicide.

Worldwide, mental illness affects one in five people aged 60+. However, problems faced by older adults impacting their mental health are often overlooked, such as loneliness, loss of a spouse, or ill-health. We need to change the way we treat mental illnesses, with services that consider older adults' specific needs and situations.

"Precision medicine" means using information we learn about someone, such their diet or lifestyle, to provide treatment/care specific to them as an individual. This has been successful with physical illnesses, such as early-diagnosis and treatment for cancer. We want to apply precision medicine ideas to help improve older adults' mental health.

Our project will create an "early-warning system" to detect when an older person might be at risk of poor mental health, so that help and support can be given to them quickly. First, we will create a computer system where health-service providers can input their patients' information and older adults vulnerable to mental illnesses can be identified. Next, we will see what sorts of services, and technologies, like virtual reality, are important to improving mental health. To ensure our system and services/technologies meet older adults' needs and are easy-to-use, older adults will be involved at all stages of the project from early ideas, to building/testing the services/technologies.

Our early-warning system will help older adults get support earlier – before things get worse – and our services/technologies will help improve their mental health. In turn, this will help health-service providers improve the care they give and get better value for money.

Project Title: Enhancing employability of older workers and family carers

Project Lead: Janet Fast (University of Alberta)

Financial well-being is foundational for short and long term physical and mental health and social inclusion. Poor financial wellness also negatively impacts employees (poorer employee engagement and productivity), their employers, and the economy more broadly. Attaining and maintaining secure employment is key to financial well-being, yet many in society experience employment instability: job loss, underemployment, precarious employment, poor quality jobs. Two particularly vulnerable groups that have received little attention until recently are older workers and family carers. The proposed project will enhance an existing web-based platform (My MatchWork) designed to help overcome employment barriers so that it serves the employment needs of these two vulnerable populations and extends its reach beyond Alberta. My MatchWork (MW), developed using collaborative, human-centred design, comprises an interactive vocational assessment and guidance tool to help people overcoming employment barriers translate their unique skills into viable employment pathways. A Software-as-a-Service application, machine learning informs the vocational matching component. The tool is coupled with ongoing training and support from MatchWork staff. It delivers accurate assessments for individuals, good matches for employers, and outcome data agencies need to support vocational initiatives. MW is currently beta testing the tool and support package with community partners. To date target at-risk groups include persons with disabilities, single mothers and immigrants, but they aspire to adapt MW to also meet employment needs of older workers and family carers. The project will utilize multiple data sources (nationally representative surveys; qualitative data on older workers' and carers' employment experiences; and data collected through the MatchWork platform) to generate knowledge that: contributes to the body of knowledge around employment challenges of older workers and family carers and the potential of the platform to address these challenges; informs product development/enhancement; and demonstrates the impact of the platform on labour market success of the target populations.

Project Title: Mobilising the older adult's voice within community-care through transforming into data their personally reported outcomes of engaging with health services

Project Lead: Deborah Fels (Ryerson University)

We believe that engagement and participation in a person's own care will increase the quality of care and satisfaction. This project will develop and evaluate a system to enable older adults to make sure their stories and feedback about their health and health care are available to healthcare providers – even between health-care visits. The system will allow people to provide a more detailed picture of what has been happening in their lives that may affect their preferences, needs, and their ability to manage. People can share their ideas, concerns, cultural practices, perceived successes and challenges, which will be filtered, and safely and securely shared with their health-care providers in a way that is acceptable and useful to all. Privacy and security features will be provided by one of the project partners, gDial, who can add advanced encryption. Together with SE Health, a large Ontario-based home and community care provider, experts in health-care delivery and person-centred design, students, a start-up company, a team of older adults receiving home and community care services, and a lab elder will co-design and test a prototype system over a three-year period. We will start with a one-year pilot phase with short develop/test cycles followed by a longer term phase. After the project, people will be able to use the system at home along with their community care team. We predict that home care and health-care providers, and family members will demonstrably make better, more informed decisions about care and the things people need. While the technology and system are commercialisable, there may also be an opportunity for the individuals who create the records to benefit from pooling their data as a common resource for societal and personal benefit. Finally, this project could serve as a model for uses beyond health care such as tourism.

AGE-WELL CRP Catalyst Projects

Project Title: Smart technologies in the home: Developing and testing strategies for seniors with severe mental illness

Project Lead: Cheryl Forchuk (Western University)

Mental illness has been found to be prevalent among the older adult population with literature suggesting that up to one in three seniors meet the criteria for a psychotic or mood disorder. Individuals with cognitive issues tend to be high users of the mental health system and require intensive supports. Functional issues may also be comorbid with cognitive and mental health issues. For these individuals there is a strong need to develop efficient and cost-effective strategies for care.

Our innovative intervention will provide community-based seniors with smartphones and touch-screen monitors as well as health monitoring devices including an activity tracker smartwatch, an automated medication dispenser, and a wireless weigh scale. Data from the health monitoring devices will be backed-up to the Lawson Integrated DataBase (LIDB) for health-care providers (HCPs) to monitor. The LIDB will also send prompts to the participants as well as questionnaire assessments, video-conferencing and messaging with HCPs. This study will use quantitative and qualitative research methods to assess the effectiveness of the intervention, the economic impacts, and potential ethical and policy issues related to smart technology. This three year study will recruit 40 participants residing in independent-living units and group homes across London, Ontario.

In order to participate, seniors must be 65 years or older, experiencing a psychotic or mood disorder, and living in a home provided by the Canadian Mental Health Association or London-Middlesex Housing Corporation.

Overall, the smart technology will aim to provide a supportive environment within the homes of seniors to promote community integration and effective chronic illness management. It is expected that an improvement in community integration will improve health outcomes and housing stability, and decrease hospitalizations.

This smart technology intervention has the potential to revolutionize how seniors and HCPs interact, leading to greater stability for living in the community.

Project Title: Development of smart homes for aging in place; at Résidences Le 1615 & Le 1625

Project Leads: Sylvain Giroux (Université de Sherbrooke), Nathalie Bier (Université de Montréal), Mélanie Couture (Université de Sherbrooke)

Aging in place is one of the top priorities of the governments of Quebec and Canada. In fact, living at home has considerable benefits for seniors and their ecosystem, including the health (physical and mental) of the elderly individual and the costs associated with health care utilization and social services. The current conjuncture of the aging of the population and the rapid development of technologies makes it possible to envisage new uses for these technologies towards developing new approaches for affordable and connected homes favouring aging in place. However, to date, global, Canadian and Quebec initiatives remain timid and the real impact of these technologies on aging-well is poorly documented. In addition, many technologies are developed without implications from the elderly or consideration of their ecosystem and, as such, do not meet the specific needs of this clientele. Consequently, the technologies are abandoned or do not give the expected results. In keeping with its mission to contribute to aging-well in Quebec through innovative solutions, the Berthiaume-Du-Tremblay Foundation (community partner) wishes to explore the potential of these technologies in order to safely keep the residents in their homes. As part of this project, which includes a close collaboration between academic circles, NPOs, industry members, seniors and members of their network, we aim to develop and integrate new technologies (such as smart environments and connected devices) to promote aging in place for seniors living alone in collective housing. Ultimately, we are aiming for the development of reliable, robust, marketable and easily deployable technology in collective housing which is compatible with the needs and requirements of these environments.

Développement d'habitations intelligentes pour le maintien à domicile des personnes âgées dans le milieu de leur choix; aux Résidences Le 1615 & Le 1625 du Quartier des Générations

Vieillir chez soi est l'une des grandes priorités des gouvernements du Québec et du Canada [1]. En effet, vivre à domicile présente de nombreux bénéfices pour la personne âgée et son écosystème, tant pour la santé (physique et mentale) de la personne âgée elle-même, que pour les coûts engendrés par la société en termes de soins de santé et de services sociaux. La conjoncture actuelle du vieillissement de la population et du développement fulgurant des technologies permet d'envisager de nouveaux usages à ces technologies pour développer de nouvelles formules d'habitation connectée, abordable et favorisant le bien-vieillir chez soi. Toutefois, à ce jour, les initiatives mondiales, canadiennes et québécoises, demeurent timides et l'impact réel de ces technologies sur le bien-vieillir est peu documenté. De plus, de nombreuses technologies sont développées en marge de la personne âgée et de son écosystème et ne répondent pas aux besoins spécifiques de cette clientèle. Conséquemment, elles sont abandonnées ou ne donnent pas les résultats escomptés. En lien avec sa mission de contribuer au bien vieillir au Québec par des solutions innovantes, la Fondation Berthiaume-Du Tremblay (partenaire du milieu) souhaite explorer le potentiel de ces technologies, afin de maintenir à domicile de façon sécuritaire les personnes qui habitent ses résidences. Dans le cadre de ce projet, qui inclut une étroite collaboration entre des milieux académiques, des

OBNL, des membres de l'industrie, des personnes âgées et leur réseau, nous visons à développer et intégrer des technologies de type environnements intelligents et objets connectés, pour favoriser le maintien à domicile des personnes âgées vivant seules en habitation collective. À terme, nous visons le développement d'une technologie fiable, robuste, commercialisable et facilement déployable dans des habitations collectives, en accord avec les besoins des milieux preneurs.

Project Title: Advanced technologies for pain care in older adults with dementia

Project Leads: Thomas Hadjistavropoulos (University of Regina), Babak Taati (KITE Toronto Rehab – UHN)

Despite its high prevalence, pain in older adults is under-assessed and undermanaged. Seniors with dementia, in particular, have difficulty communicating the subjective state of pain due to severe cognitive impairment. Behavioural pain manifestations in this population are often misattributed to psychiatric disturbances which are subsequently managed with antipsychotic rather than analgesic medication. Antipsychotic medication has been shown to hasten death and increase the occurrence of falls. Other deleterious consequences of undertreated pain include depression/anxiety, sleep disturbance, isolation, increased health-care costs, longer hospital stays, and overall declines in quality of life. Our work will address this challenge and will involve the following: a) continuing development of computer vision technologies to monitor pain behaviours and warn long-term care (LTC) staff when pain appears to be present. This improved diagnostic tool will help address human resource limitations that limit the frequency of pain assessment. Our focus during AGE-WELL 2.0 will be on further improvement of our algorithm developed during Phase I, so that it works from side views of the face and in contexts where more than one patient is present. We also plan larger field testing of our system during AGE-WELL 2.0; b) app refinement and further development to facilitate the monitoring and recording of pain behaviours by LTC staff; c) refinement and dissemination of interactive web-based platforms capable of providing cutting edge pain education to LTC staff who may be residing in rural and remote areas; d) public policy work to facilitate adoption of our products and to address other policy gaps in senior care. We will continue to work with all stakeholders and anticipate that our work will improve LTC pain care practices in Canada and beyond by providing effective, inexpensive, well validated and well disseminated pain care tools.

Project Title: Location tracking-based health status indices and their integration into clinical support tools in long-term care.

Project Leads: Andrea Iaboni (KITE Toronto Rehab – UHN), Shehroz Khan (KITE Toronto Rehab – UHN)

Technology is an important solution to alleviate resource gaps and augment the delivery of care in seniors residential settings such as long-term care and retirement homes. We and other researchers have been working towards developing behavioural and health status monitoring technology for use in seniors residential care, but cost, acceptability, integration, and clinical usefulness have all been significant barriers to innovation. Real time locating systems (RTLS) are an existing form of technology employed in healthcare settings for safety (wandering prevention) and individual or asset tracking. These systems produce a vast amount of data about an individual's movements in space and time, and preliminary research has shown that clinically meaningful information can be extracted from this data. In this project, we seek to harness this source of health-care data to create Space Time Indices for Clinical Support (STICS). These indices will be used to track health status measures such as "Physical Activity" and behavioural measures such as "Social Engagement" and "Motor Activity." Over a three-year project and across four sites, we will work with our industry partner CareBand to collect a project databank of RTLS and clinical data to be used to develop STICS. These STICS will be integrated within evidence-based clinical decision support tools (CSTs) to guide clinical care. The two starting points for this project are resident values and clinical relevance. Guided by the principles of responsible research and innovation, we will undertake a consultation with health-care professionals, families, residents and residential care providers to complete an ethical and policy analysis and develop an implementation plan that takes into account these different perspectives. Our research team includes scientists and students across the fields of computer science, engineering, nursing, geriatric psychiatry, rehabilitation and implementation sciences, working together to improve the quality of care for seniors in residential care.

Project Title: Indigenous methodologies: Building capacity for telediabetes care in Urban Indigenous communities. (I'M T'CARE)

Project Leads: Charlotte Jones (University of British Columbia), Donna Kurtz (University of British Columbia)

Among First Nations in Canada, diabetes prevalence peaks at age 55-64; rates almost four-fold higher than the general population (36.4% versus 9.9%) Representing more than half of Indigenous peoples in Canada, urban (off-reserve) Indigenous people face disproportionately poorer diabetes-related outcomes secondary to access barriers, racism, structural violence, lack of culturally safe care. Geographic/jurisdictional challenges limit diabetes services such as telediabetes.

Telehealth is welcomed and cost-effective in those > 40 years old but outcomes for Indigenous older adults (Elders) are lacking due to their minimal access to collaboratively developed culturally safe telediabetes programs; thus highlighting community-driven needs.

Our CIHR grant, "Building Indigenous Pathways for Diabetes and Obesity Prevention and Management with Urban and Rural Communities in British Columbia" (IDOH2), partners with six BC Interior urban Friendship (FC) and Métis Centers (MC) (off-reserve). These communities identified the need for e-health/telediabetes and electronic medical record (EMR) access.

This 3-year project will examine, in partnership with IDOH2 Friendship/Métis partners and Advisory Teams, how multidisciplinary telediabetes "one-stop" care impacts access and health outcomes for urban Indigenous older adults and caregivers.

Outcomes: Indigenous physicians and local providers are trained diabetes "experts", culturally safe multidisciplinary telediabetes clinics are embedded within FC/MC programming; Indigenous older adults, caregiver/families access and benefit from services; an Indigenous telediabetes "expert" training and implementation toolkit is disseminated across Canada and beyond.

Knowledge generated addresses a community-identified need, reduces diabetes-related inequities and significantly increases access to specialist/expert care in urban older Indigenous populations. University-community-health authority collaboration influences urban Indigenous policy/health service development. Indigenous workforce capacity is enhanced by increasing skills/knowledge of Indigenous physicians, local providers, trainees and community members. FC/MCs increase capacity to participate/conduct/guide research, advocate for resources, and sustained program/service funding.

Project Title: Living More with SMART Technology: Exploring the feasibility, usability, sustainability and scalability of SMART solutions to support increased quality of life in continuing care

Project Leads: Susan Kirkland (Dalhousie University), Margaret Szabo (Northwood)

Older adults value autonomy and independence as key features of healthy aging. SMART technology has enormous potential to foster healthy aging and independence by combining elements of gerontology and rehabilitation with technology to create solutions for disability related to impairment and/or aging. Most research to date has focused on maintaining autonomy and independence in community; less attention has been placed on understanding how to maintain autonomy and independence when 'home' is an institutional setting such as long-term care. Current solutions are often not personalized or lack long-term support; those that are individualized are often labour intensive and costly. The goal of Living More with SMART Technology (LivMoreSMARTech) is to support technology development and use that is transdisciplinary and 'fit for purpose' for improving the independence, functioning, well-being and quality of life of older adults in continuing care. Our aims are: 1) to understand the lived experience, needs and desires for well-being among older adults with complex conditions in continuing care; 2) to implement and evaluate off-the-shelf technology solutions, individually customized to maximize well-being, that are supported and sustainable; and 3) to understand how best to incorporate sustainable, person-centred technology solutions into long-term care and continuing care settings that result in scalable outcomes including adoption into organizational policies, procedures, programs and care planning. We employ a co-design approach to empower older adults to actively participate in the research – from expressing needs and desires in order to maximize their well-being, to involvement in planning of potential solutions, implementing solutions, and evaluating the solutions. Knowledge mobilization activities will be employed throughout. LivMoreSMARTech will contribute novel and necessary insights to the overall AGE-WELL initiative and provide models, guidelines and recommendations to support technology solutions in continuing care, a sector that has been under-represented in the context of aging and technology.

Project Title: Beyond Ability411: A participatory action research study to scale-up a web-based service about assistive technologies for older adults in British Columbia

Project Leads: Karen Kobayashi (University of Victoria), Elizabeth Borycki (University of Victoria)

In addition to navigating the increasing complexity of health care and health service delivery systems to maintain autonomy and independence, older adults and their families experience numerous barriers to identifying and accessing appropriate supports. While commercially available assistive technologies (ATs) promise a generic solution to such a challenge, older adults find it difficult to identify specific, effective ATs that meet their needs. Ability411 is a web-based service that provides practical information about assistive technologies and equipment to older adults, their family members and their health-care providers in BC (see – https://www.ability411.ca/). This is a functioning website, developed by CanAssist (our technology developer partner) that has had usability testing and is currently being considered for potential integration into the BC Government's HealthLink suite of web-based services. This project will develop extensions to the Ability411 platform that address challenges for different stakeholder groups, along with ensuring that information provided is relevant to the needs and interests of individuals in these groups (i.e., older adults, their family members, caregivers, health authority staff, NGOs, Ministry of Health decision-makers and commercial developers/suppliers). The team will use a participatory action research approach with a 'continuous codesign' methodological strategy, allowing specific stakeholder groups to provide ongoing input into the design process. Further development will include the creation of a recommender system to include algorithms (e.g., machine learning) that will suggest evidence-based software and devices that can be used by older adults, their families and health professionals, providing real-time data analysis and recommendations tailored to the stakeholder users' needs. The platform will be adapted to provide stakeholders with a portal interface that is specific and adaptive to their group's needs, and will be developed and tested during the co-design process.

Project Title: Technologies for assessment and management of wayfinding risks for persons living with dementia in their communities

Project Lead: Lili Liu (University of Alberta)

Problem statement: According to the Alzheimer Society of Canada, over half a million Canadians are living with a dementia and this number will double in 12 years, by 2031. With the passing of Bill C-233, Canada becomes the 30th country to launch a national dementia strategy. This strategy will coordinate existing provincial dementia strategies and related initiatives and programs to address the "overwhelming scale, impact and cost of dementia" (https://alzheimer.ca/en/Home/Get-involved/Advocacy/National-dementia-strategy-guide). AGE-WELL NCE is perfectly situated to be a leader in addressing the challenges of caring for the growing number of older adults living with dementia. It is commonly known that 3 out of 5 people with dementia wander. This statistic lacks specificity and does not inform decision- and policy-makers. In 2018, Alberta and Manitoba amended their Missing Persons Acts to include "Silver Alert"; and currently there is a national petition for a national silver alert program. Data and research are needed to inform these programs.

Research purpose: The purpose of this proposal is to examine the applications of technologies for assessment and management of wayfinding risks for persons living with dementia in their communities. We propose four studies.

Anticipated impacts: Impacts are seen through five products: (1) a reliable and validated measure that predicts risks of getting lost, (2) a mobile app that uses the predicted risk levels to recommend a personalized strategy for people with dementia and their care partners to mitigate these risks of getting lost, (3) a brief scale to assess the usability of technologies used to locate a person who is lost, (4) a national coordinated strategy for the collection of data on missing older adults to inform programs, product designs and policies, and (5) algorithm-equipped drones for finding cognitively impaired people who are lost.

AGE-WELL CRP Catalyst Projects

Project Title: SMART - Socially mobile assistive robots for telecare and daily activities of older adults

Project Leads: François Michaud (Université de Sherbrooke), Goldie Nejat (University of Toronto)

Socially Assistive Robots (SARs) can uniquely provide assistance to human users through social interaction. A great variety of SARs for elderly care have been designed, tested and evaluated, and even though they demonstrate great potential, they still only remain research endeavors. Why? Many factors come to play, such as 1) the cost and investment required to bring to market and maintaining these robots, 2) finding the right application where user expectations and SARs' capabilities are both met, and 3) providing compelling evidence to help propel the necessary changes to policies and regulations to support their use in real world settings. The SMART core project proposal aims to set up the needed environment to evaluate SAR technologies through field trials in long-term residences and homes. Doing so will help identify needs, requirements and barriers, which will orient technological research activities, through iterative co-design cycles with incremental refinement and exploration. It will also generate opportunities to identify technology spin-offs for specific applications, to gradually get them to market. Since health services in Quebec, Ontario and throughout Canada are largely under state control, we want to exploit such "living-lab" experimental settings to study how to influence public policy-makers for state orientations in the short, medium and long term. Our goal is to help move policy-makers beyond what are frequently reactive responses to technological breakthroughs, by identifying settings and frameworks that will facilitate a more timely and effective transfer of knowledge from the SAR research community to decision-makers. The anticipated impacts of SMART involve A) creating a field-trial experimental framework where a diverse group of SAR technologies can be demonstrated and studied; B) identifying the conditions of success for knowledge mobilization, knowledge and technology exchange and exploitation, from an engaged community of users and stakeholders to the policy-makers.

Project Title: Inclusive interactive apps to reduce older adults' social isolation and digital marginalization

Project Lead: Cosmin Munteanu (University of Toronto)

An increasing number of older adults report being socially isolated – potentially affecting many aspects of fulfilling, healthy and safe golden years. At the same time, advances in novel mobile, online and smart technologies afford new opportunities to stay connected to our loved ones or to our community peers, or to simply increase our quality of life by making access to services and products much easier. To this extent, older adults who live socially isolated could benefit from a greater digital participation; yet, the current ecosystem of design paradigms, interfaces, digital services and knowledge excludes many of them from fully benefiting from these. We are proposing to break this cycle of digital marginalization / social isolation and empower older adults to live more independently and socially more connected through the design of new interactive technologies. We will investigate and design interactive, multimodal and connected technologies that are inclusive of older adults' needs, abilities and contexts (technology outcomes). We aim to achieve this through a new design approach that is grounded in a transdisciplinary model of collaboration between diverse academic investigators (from computer science to user experience design and to narrative gerontology), target users, community stakeholders and tech industry (practice outcomes). The resulting products consist of a set of new applications, deployed on emerging digital platforms (mobile, VR, tabletop, etc.) that will enable older adults' increased participation in the digital space, reduce social isolation and facilitate meaningful connections to family members. These will be evaluated through field deployments facilitated by the diverse range of our partner stakeholders (NGOs, service delivery organizations, community groups, tech companies, civic society organizations). This will produce new models of sustainable deployment of senior-centred digital tech (service delivery outcomes) as well as ethical and empowering design and community-driven tech development principles for such applications (policy outcomes).

AGE-WELL CRP Catalyst Projects

Project Title: Introducing new technology to monitor the health data of older adults with multi-morbidities related to dementia in Indigenous communities

Project Lead: Megan O'Connell (University of Saskatchewan)

Problem Statement: Indigenous older adults living in rural communities have multiple morbidities that may lead to early onset dementia, yet lack the accessibility to and readiness for new technologies to monitor health data and consequently health status. Compounding this problem is the fact that Indigenous older adults living in rural communities also lack the health education needed to understand the ways nutrition, exercise and self-management of health issues can impact multiple morbidities and how multiple morbidities can be related to early dementia onset. Our research aims to promote a healthy lifestyle by providing Indigenous communities with the ability to make conscious, informed decisions about their health through technology use.

Research Purpose: Introducing new technology to monitor health data and promote healthy behaviours and healthy lifestyles and evaluating its impacts. In southern Saskatchewan, there is an opportunity to use new technology which allows Indigenous older adults to monitor their own diabetes and age-related health information, including blood glucose, blood pressure, weight, and other data. This data can then be shared with their health practitioner and the research team so it can be tracked and graphed and reported on.

Anticipated Impact: It is anticipated the health data of the participants will change substantially as they learn more about healthy lifestyles and risk factors of dementia. This project will be welcomed in the community because our community partner, the File Hills Qu'Appelle Tribal Council (FHQTC) operates the All Nations Healing Hospital where participants can access services locally. We anticipate that our research will impact and slow down the early onset of dementia in Indigenous communities. The community will be more involved in their own health outcomes and will recognize the benefits of local Indigenous research.

AGE-WELL CRP Catalyst Projects

Project Title: Game design service platform for seniors' health and well-being

Project Lead: Patrick Plante (TELUQ University)

Research in the field of serious and therapeutic games (STG) has been on the rise in recent years, particularly with regard to the development of games for the elderly. The objectives of these STG are the adoption of healthy lifestyles, lifelong learning, adaptation and rehabilitation in order to improve the quality of life. The STG partly compensate for the motivation that is not always there and which requires different leverage with age and context. However, due to the difficulties inherent in research and development, many projects do not result in the development of a product that is accessible to seniors. Some STG do not have an effective design despite a promising concept, others are not hosted online. Still others do not have the technical infrastructure to collect usage data. Research produces scientific results, but the end of funding often marks the end of the STG. Thus, our project has two general objectives: to produce STG much more quickly and effectively, and to allow STG to persist and be accessible to seniors beyond the period of research funding. To achieve this, our research group will design a centralized service platform that can provide expertise to researchers, but also to practitioners and seniors, among others, who wish to produce a STG or who have needs that can be met by these technologies. A first STG will be produced and evaluated in collaboration with Le Réseau québécois de la recherche sur la douleur. Supported by an innovative business model, the Digital Game Design Service Platform for Seniors' Health and Well-being is an ambitious and innovative project that will transform several issues related to STG research and development into opportunities for successful collaborations for the benefit of seniors.

Service de conception de jeux numériques pour la santé et le bien-être des aînés

La recherche dans le domaine des jeux sérieux et thérapeutiques (JST) est en forte progression ces dernières années, et notamment en ce qui concerne le développement pour les aînés. Ces JST ont pour objectifs l'adoption de saines habitudes de vie, l'apprentissage tout au long de la vie, l'adaptation et la réadaptation afin d'améliorer la qualité de la vie. Les JST viennent en partie pallier à la motivation qui n'est pas toujours au rendez-vous et qui nécessite des leviers différents avec l'âge et le contexte. Cependant, en raison des difficultés inhérentes à la recherche-développement, beaucoup de projets n'aboutissent pas au développement d'un produit accessible aux aînés. Certains JST n'ont pas de design efficace malgré un concept porteur, d'autres ne sont pas hébergés en ligne. D'autres encore n'ont pas l'infrastructure technique pour collecter les données d'usage. Les recherches produisent des résultats scientifiques, mais la fin du financement sonne souvent le glas du JST. Ainsi, notre projet a deux objectifs généraux, soit de produire des JST beaucoup plus rapidement et efficacement, et de permettre aux JST de persister et d'être accessibles aux aînés audelà de la période de financement d'une recherche. Pour y arriver, notre groupe de recherche va concevoir une plateforme de services centralisés pouvant fournir une expertise aux chercheurs, mais aussi aux praticiens et aux aînés, entre autres, qui désirent produire un JST ou qui ont des besoins pouvant être comblés par ces technologies. Un premier JST sera produit et évalué en collaboration avec Le Réseau québécois de la recherche sur la douleur. Soutenue par un modèle économique novateur, la plateforme de service de conception de jeux numériques pour

la santé et le bien-être des aînés est un projet ambitieux et innovant qui transformera plusieurs problèmes liés la recherche-développement de JST en possibilités de collaborations fructueuses au bénéfice des aînés.

Project Title: Designing Innovative Social Robots through end-User ParTicipation (DISRUPT)

Project Leads: Julie Robillard (University of British Columbia), Jesse Hoey (University of Waterloo)

Social robots are designed to help humans by interacting and communicating with them. These types of robots are promising in their potential to act as companions for older adults with and without dementia and their caregivers, and to support them in aging at home. Social robots can also help with brain health, for example by reducing stress and providing reminders for daily activities. Despite these benefits, few older adults use social robots, due to misunderstandings about what robots can and cannot do, difficulties in connecting with the robot, and concerns about ethical issues. The goal of the Designing Innovative Social Robots through end-User ParTicipation (DISRUPT) project is to test a new approach for the development of social robots that brings together different disciplines and lived experience experts in a co-creation process. In a first step, we will use surveys and interviews to gain a better understanding of the emotions older adults experience when they interact with social robots. In a second step, we will host workshops with older adults, computer scientists, robotics engineering, ethicists and health-care researchers to identify how social robots could best help older adults and to co-create two prototypes that can respond to user emotions. The DISRUPT team will measure whether the co-creation process is effective, so we can inform the research community about new ways of developing technology. The DISRUPT project will also include different knowledge exchange activities, like tweet chats and webinars. During these activities, we will analyse people's attitudes towards the DISRUPT research and social robots, and use these data to draft policy recommendations for social robots in Canada. Altogether, the DISRUPT project will play a key role in showcasing the benefits of engaging older adults in research, social robot co-creation and policy, and in advancing the field of social robotics.

AGE-WELL CRP Catalyst Projects

Project Title: Wearable technology implementation and innovation to prevent fall-related hip fractures and traumatic brain injuries in older adults

Project Leads: Stephen Robinovitch (Simon Fraser University), Fabio Feldman (Fraser Health), Kathryn Sibley (University of Manitoba), Andrew Laing (University of Waterloo)

Problem Statement: Falls cause 95% of hip fractures and up to 80% of traumatic brain injuries (TBI) in older adults. The rates of falls and injuries are at least 2-fold greater for older adults in long-term care (LTC) and acute care compared to those living independently. Falls management in LTC and acute care requires complementary efforts for preventing falls, and for preventing injury when a fall occurs.

Research Purpose: The proposed program of team research addresses the need to facilitate sustainable uptake with proven technologies, and to develop new technologies for preventing fall-related hip fractures and TBI. Approach: Our projects draw together partners in health care, industry and academia to address evidence-to-practice gaps in fall injury prevention technology. In Project 1, we will co-develop and evaluate strategies to increase uptake with wearable hip protectors, a technology that has proven cost-effectiveness but generally low compliance in LTC. We will build on our success in implementing hip protectors in LTC in BC's Fraser Health Authority (FHA), where hip protectors are worn in 60% of falls, and reduce fracture risk 3-fold. We will operationalize, adapt and evaluate the FHA hip protector implementation model to LTC sites in Schlegel Villages (SV) in Ontario, where hip protectors are worn in less than 7% of falls. In Project 2, we will co-design and evaluate the usability of wearable technologies to prevent fall-related TBI in LTC and acute care sites in FHA and SV, including unobtrusive products that provide "hidden" protection to the brain during a fall.

Anticipated impacts: Our deliverables include evidence-based strategies for implementing hip protectors in LTC, and unobtrusive wearable devices designed to prevent fall-related TBI in LTC and acute care. We will also generate new evidence on the facilitators to successful implementation of wearable technology for fall injury prevention in these settings.

AGE-WELL CRP Catalyst Projects

Project Title: Cognitive assessment with speech and machine learning

Project Lead: Frank Rudzicz (University of Toronto)

Assessing Alzheimer's disease (AD) and dementia is an expensive and laborious process that is unsustainable given our rapidly aging population, especially if one accounts for indirect costs such as lost time in travel, wait times and hours spent in assessment, which is a process so laborious that it is often repeated only every few years. Moreover, the high variability of symptoms in AD cannot be ascertained accurately from a single assessment, which minimizes the effectiveness of current practice. Rapid, repeatable and remote assessment is essential. Many individuals with dementia have diminished language abilities. Linguistic measures, like the ratio of pronouns to nouns, relate strongly to cognitive decline. By measuring such features and using advanced machine learning software, we have developed computational methods that are over 92% accurate in identifying Alzheimer's disease from short speech samples. As we continue to improve this technology, we will make it available over the public phone network accessible by a 1-800 number. This system will automatically receive calls from (and make calls to) outpatients, and completely automate speech-based tests including question- answering, narratives and random item generation. This will be encapsulated in an interface that health-care workers can use to assign and monitor assessments and exercises. The current project brings together one of the top AI startups in Canada (WinterLight Labs, who are commercializing this technology), one of the top long-term care and retirement residences (Revera), and one of the top telecom companies (TELUS). In this project, we will further refine this technology over the telephone network to rapidly expand and scale the service, evaluate clinical measures of test-retest validity and apply modern methods of 'explainable AI'.

AGE-WELL CRP Catalyst Projects

Project Title: Building technology-enabled, aging-focused rapid learning health systems in Canada

Project Leads: Michael Wilson (McMaster University), John Lavis (McMaster University)

Harnessing the innovative technologies developed through AGE-WELL (e.g., to capture, link and share data about key indicators such as patient experiences, clinical encounters, costs and health status) is critical for enabling rapid-learning health systems (RLHS). RLHS refer to the combination of a health system and a research system that at all levels – self-management, clinical encounter, program, organization, regional (or provincial) health authority and government – is:

- anchored on the needs, perspectives and aspirations of the people it is designed to serve;
- driven by timely data and evidence;
- supported by appropriate decision supports and aligned governance, financial and delivery arrangements; and enabled with a culture of and competencies for rapid learning and improvement.

Our overall goal is to spark action towards building technology-enabled RLHS for the aging population in Canada and will pursue two specific goals:

- identify in-depth insights about current community 'best practices' in aging for RLHS;
- spark collective action based on citizens' values and preferences and stakeholders' insights for building a technology-enabled RLHS in the aging space.

For goal 1, we will conduct qualitative case studies of purposively selected 'best practices' related to aging in Canada by identifying whether, how and with what impact they have used technology to enable an RLHS approach. For goal 2, we will convene four citizen panels in Canadian regions followed by stakeholder dialogues with leaders who can provide unique insights as well as champion the changes needed to support and ultimately build technology-enabled RLHS in aging.

The potential for cross-jurisdictional impact is significant. The tangible insights from our analyses will be essential for decision-makers to make the investments and/or transformation needed for implementing RLHS for the aging population in Canada. This will position AGE-WELL at the forefront of championing a highly innovative approach to strengthening health systems across Canada.