



The Interplay between Vascular Cognitive Impairment and Heart and Brain Conditions

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Facts

What is vascular cognitive impairment?

- Vascular cognitive impairment is a condition of the brain and its blood vessels that can cause challenges with abilities such as attention, judgement, problem solving, memory, and language.
- Over the past decade, hospitalizations for vascular cognitive impairment have increased by 35%.¹ It is estimated that over the next 10 to 20 years, the prevalence of vascular cognitive impairment will double every 5.3 years.²
- The combined Canadian healthcare system costs and out-of-pocket caregiver costs for dementia (including vascular dementia, the most serious form of vascular cognitive impairment) amounted to \$10.4 billion in 2016. By 2031, this figure is expected to increase to \$16.6 billion.³

Vascular cognitive impairment, heart disease and stroke

- In Canada, nine in ten people have at least one risk factor for heart conditions, stroke or vascular cognitive impairment.⁴
- Vascular cognitive impairment affects up to 60% of people who have experienced stroke.⁵ The link between stroke and vascular cognitive impairment is a two-way street – stroke may cause vascular cognitive impairment, but individuals with vascular cognitive impairment also have up to a 68% increased risk of fatal stroke.⁶
- The presence of coronary artery disease is associated with a 45% increase in the risk of dementia, cognitive impairment or cognitive decline.⁷
- Having had a myocardial infarction is associated with an increased risk for dementia, cognitive impairment, or cognitive decline.⁷
- Cognitive impairment is common in people with heart failure⁸⁻¹⁰; an estimated 25% of people with heart failure also have impaired cognitive function.⁸
- People with atrial fibrillation are up to three times more likely to experience some degree of cognitive decline and 1.4 to 2.3 times more likely to develop dementia.^{11,12}

Vulnerable populations

- Heart disease and stroke are leading causes of premature death for women in Canada.¹³ In fact, 45% more women die of stroke than men¹⁴ and because women live longer, more women are living with the effects of stroke.¹⁵
- In 2017, more women died of vascular cognitive impairment than men. A dementia diagnosis is also more likely in women than in men.¹⁶

- Almost two-thirds of First Nations people have at least one chronic condition compared with only half of the total Canadian population.¹⁷
- Due to the higher burden of chronic illness borne by Indigenous peoples in Canada, the risk of vascular cognitive impairment and the prevalence of dementia in Indigenous populations is higher than for non-Indigenous populations.^{18,19}
- Dementia is a relatively new phenomenon in Indigenous communities in Canada and Indigenous communities identified it as an emerging health priority in 2007.²⁰

Pre-disposing risks

- According to the Lancet Commission on Dementia, twelve pre-disposing risks – less education in early life, hearing loss, traumatic brain injury, hypertension, alcohol consumption, obesity, smoking, depression, social isolation, physical inactivity, air pollution and diabetes – account for 40% of dementia worldwide.²¹
 - Physical activity can protect individuals from cognitive impairment and vascular dementia in later life.²² Older adults are more likely to partake in physical activity if their neighbourhoods are safe, walkable, aesthetically pleasing, and destinations and services are easily accessible.²³
 - Diets high in vegetables, fruits, whole grains, legumes and healthy unsaturated fats from nuts, seeds, and vegetable oils (especially olive oil), moderate in fish, poultry, eggs and dairy and low in meat, processed meats and sweets. (e.g., Mediterranean-style diets) can reduce the risk for mild cognitive impairment.²⁴
 - More years of formal education were associated with less cognitive decline and a lower risk of developing a clinical diagnosis of vascular cognitive impairment compared to having fewer years of formal education.²⁵
 - Economically vulnerable populations are more susceptible to smoking^{26,27} which is an independent risk factor for vascular dementia.²⁸⁻³⁰
 - Individuals who report more feelings of loneliness and have lower levels of social participation or engagement, are at an increased risk of developing dementia.³¹⁻³³ On the other hand, having good levels of social engagement and interaction is protective against the development of dementia.³³

Caregivers and people living with vascular cognitive impairment

- Vascular cognitive impairment can affect how individuals communicate with others, making it difficult to express thoughts or feelings and maintain personal relationships.
- The stigma associated with cognitive conditions may also prevent individuals living with vascular cognitive impairment from reaching out to support networks, further isolating them from their family and friends
- People living with vascular cognitive impairment may have a declining ability to care for themselves and their families, which can lead to an added burden for caretakers
- Informal caregiving for someone with vascular cognitive impairment requires a significant time commitment of an estimated 81.4 hours per month.³⁴ This can increase to 111.4 hours per month when caring for someone with severe cognitive impairment.³⁴

Policies

- Strategies for addressing vascular cognitive impairment need to extend beyond downstream approaches such as treatment, and include upstream preventative approaches.
- Governments can play a unique role in addressing the pre-disposing risks of vascular cognitive impairment through a combination of health promotion, policy and funding initiatives. This includes policies to address physical activity, food environments, tobacco access and community infrastructure.

Background

Vascular cognitive impairment is a condition where damage to the blood vessels of the brain leads to injury of brain tissue. Vascular cognitive impairment may be caused by stroke, tiny clots that block small blood vessels in the brain, bleeding from small blood vessels in the brain, or blood vessel wall disease, as well as other heart conditions which result in a lack of blood flow and oxygen to the brain, damaging brain cells. Risk factors for vascular cognitive impairment may include conditions like heart failure, diabetes and high blood pressure. Vascular cognitive impairment can cause symptoms that can range from mild forgetfulness to more serious challenges with awareness, thinking, attention, memory, language, and executive functions like problem solving.

Over the past decade, hospitalizations for vascular cognitive impairment have increased by 35%.¹ As the population in Canada ages, the number of individuals diagnosed with vascular cognitive impairment will continue to increase significantly over the next 10 to 20 years.² In fact, it is estimated that the prevalence of vascular cognitive impairment will continue to double every 5.3 years.²

The most serious form of vascular cognitive impairment is called vascular dementia. Vascular dementia can cause difficulty with everyday activities like getting dressed and bathing. Vascular dementia and Alzheimer's disease can share some similar signs and symptoms, can exist separately or together, but they are not the same condition. In fact, on average, people with vascular dementia have a shorter life expectancy following diagnosis than those with Alzheimer's disease.³⁵

In 2008, the average per-person health service use for those diagnosed with dementia (including vascular dementia) was \$7,092.³⁶ When the direct and indirect costs of care are taken into consideration, the combined Canadian healthcare system costs and out-of-pocket caregiver costs for dementia amounted to \$10.4 billion in 2016. By 2031, this figure is expected to increase to \$16.6 billion.³

Pre-disposing conditions

Many roads can lead to vascular cognitive impairment, including the presence of pre-disposing conditions. Individuals who have heart and brain conditions are at a greater risk for developing vascular cognitive impairment. This increased risk is due to the interconnectedness of the heart and brain with the body's network of oxygen and nutrient-rich blood vessels. Heart disease and stroke are a leading cause of death and disability in Canada and every 5 minutes a person in Canada dies from heart conditions, stroke or vascular cognitive impairment.³⁷ In Canada, 9 in 10 people have at least one risk factor for heart conditions, stroke or vascular cognitive impairment.⁴ Many other disease conditions are also linked with vascular cognitive impairment including diabetes, auditory and hearing loss, and sleep disordered breathing although the research into these risks is still new and emerging.

Significant investments in prevention, care and recovery for people living with pre-disposing conditions and vascular cognitive impairment are needed by governments to address this future burden on Canadian healthcare services.

Stroke: A stroke happens when blood stops flowing to a part of the brain or bleeding occurs in the brain, leading to death of brain cells. The effects of a stroke depend on the part of the brain that is damaged, and the amount of damage done. Types of stroke include ischemic stroke, transient ischemic attack (TIA), and hemorrhagic stroke. More than 89,000 strokes occur in Canada each year and that number continues to rise.³⁸ Stroke is a leading cause of adult disability; over 878,000 people in Canada are living with the long-term effects of stroke and this number is expected to continue increasing.^{38,39} In 2016, more women than men died of stroke in Canada,⁴⁰ and more women than men are living with the effects of stroke including more activity limitations and worse health related quality of life.^{15,41}

Vascular cognitive impairment affects up to 60% of people who have experienced stroke.⁵ Of those who have suffered a stroke, 10% will already have some vascular cognitive impairment and another 10% will develop vascular cognitive impairment after their stroke.⁴² An additional 30% of people who experience a second stroke are at risk of developing vascular cognitive impairment.⁴² The link between stroke and vascular cognitive impairment is a two way street. Individuals with vascular cognitive impairment also have up to a 68% increased risk of fatal stroke.⁶

The presence of both stroke and vascular cognitive impairment in individuals creates care needs that are more complex. As a result, 29% of people admitted to hospital for stroke and concurrent vascular cognitive impairment were sent to long-term care instead of returning home, compared to 5% of people admitted for stroke without vascular cognitive impairment.⁴³

Coronary artery disease: Coronary artery disease develops when the major blood vessels that supply the heart with blood, oxygen and nutrients are damaged or diseased. Normal blood flow is disrupted due to the stiffening, narrowing, or blocking of blood vessels. In Canada, over 32,000 deaths a year are related to coronary artery disease.⁴⁴ Vascular cognitive impairment can co-exist with coronary artery disease,⁴⁵ and in fact, coronary artery disease is associated with a 45% increase in the risk of dementia, cognitive impairment or cognitive decline.⁷

Myocardial infarction: A myocardial infarction, also known as a heart attack, occurs when blood flow to the heart muscle is reduced or stopped. While the most recognized symptom for myocardial infarction is chest pain, women often experience other symptoms including fatigue, shortness of breath, sleep disturbance and indigestion.⁴⁶ As a result, their symptoms frequently go unrecognized, preventing women from receiving necessary care.⁴⁶ Having had a myocardial infarction is associated with an increased risk for dementia, cognitive impairment, or cognitive decline.⁷ Compared with the general population, myocardial infarction is associated with a higher risk of vascular dementia.⁴⁷

Heart failure: Heart failure is a complex syndrome caused by weakening of the heart such that it is unable to pump blood adequately to meet the needs of the body. At least 650,000 people in Canada are living with heart failure,⁴⁸ and in 2017, 20% more women than men died of heart failure.⁴⁹ Compared to men, women with heart failure are older, frailer, have more comorbid conditions, and are of lower economic status.⁵⁰ Cognitive impairment is common in people with heart failure⁸⁻¹⁰; an estimated 25% of people with heart failure also have impaired cognitive function.⁸

Atrial fibrillation: Atrial fibrillation is a condition affecting many Canadians.⁵¹ It is an irregular heart rhythm that occurs when there is irregular contraction of the heart's atria (upper chambers

of the heart). People with atrial fibrillation are up to 3 times more likely to experience some degree of cognitive decline.¹¹ Atrial fibrillation can also increase one's risk of stroke due to blood pooling in the atria (upper chambers of the heart) leading to clots forming; hence people with atrial fibrillation have a 3-5 times greater risk for stroke.⁵² As with other heart conditions, women with atrial fibrillation have unique needs. Hospital readmissions are 1.2 times higher in women with atrial fibrillation than men,⁵³ and women have a higher risk of stroke and death.⁵⁴

Congenital heart disease: Congenital heart disease refers to any defects in the heart valves, great vessels, heart walls or chambers of the heart that are present at birth. People with congenital heart disease (whether mild, moderate or severe) have an increased risk of dementia.⁵⁵ Congenital heart disease differs from other heart diseases as it requires lifelong medical care.⁵⁶ Only 23% of adults with congenital heart disease in Canada are being followed in a congenital heart disease centre; the remainder are considered "lost to follow-up", some with gaps in care of 10 years or more.⁵⁷

This gap in services means those living with congenital heart disease may be unaware of their increased risk for other conditions, including vascular dementia.⁵⁵ Adults living with congenital heart disease are also at higher risk for a variety of other health issues that may also increase the risk for vascular dementia including heart rhythm problems, heart failure, stroke and coronary disease.^{58,59} Hospitalizations for congenital heart diseases have increased in recent years and the number of children and adults with congenital heart disease being hospitalized increased by 1.3% and 4% per year, respectively.⁶⁰ This increase highlights the need for necessary resources and plans to be put in place to properly transition people with congenital heart disease from pediatric care to adult care.

Hypertension: Hypertension, or high blood pressure, is a major contributor to disability-adjusted life years and affects nearly one in four adults in Canada.⁶¹ Hypertension is a major risk factor for stroke, and 53% of those hospitalized for a stroke or transient ischemic attack also have hypertension.⁶² It is also a major risk factor for coronary artery disease, and 59% of those hospitalized for coronary artery disease also have hypertension.⁴⁵

Those with a current diagnosis of hypertension have almost twice the risk of vascular dementia compared with those without hypertension.⁶³ Original research into the mechanisms by which this occurs suggests that large artery stiffness and microvascular damage caused by hypertension is associated with impaired cognitive function.⁶⁴

A Cochrane review of four high quality clinical trials found no association between risk of dementia and treatment of blood pressure in later life.⁶⁵ More research is needed on the effectiveness of blood pressure treatments on risk for dementia. Consid-

erations should be made for the age of treatment initiation, the duration, and the dose of the treatment. Ongoing surveillance of blood pressure is also necessary to ensure those with high blood pressure are diagnosed early so treatment can begin.

Diabetes: Diabetes can lead to aggressive atherosclerosis, which is the buildup of fat along the artery walls.⁶⁶ As a result, individuals with diabetes have increased risks of cardiovascular disease, stroke and myocardial infarction.⁶⁶ Diabetes is also a powerful catalyst for vascular inflammation.⁶⁶ However, there is substantial evidence that Type 2 diabetes can be managed by modifying associated risks including unhealthy diet, physical inactivity and smoking.⁶⁶

The findings from one comprehensive review suggest that having diabetes is associated with a 49% increased risk of mild cognitive impairment.⁶⁷ Moderate evidence also suggest having diabetes is associated with almost a doubling in the risk of progression from mild cognitive impairment to vascular dementia.⁶⁷ Worryingly, individuals with prediabetes are also at an increased risk.⁶⁷

Auditory and hearing loss: Age-related hearing loss (ARHL) is a progressive disorder that becomes more common and advances as individuals age.⁶⁸ Newer evidence suggests there is an association between ARHL, cognitive decline and dementia, including vascular dementia.^{68,69}

One study finds that the risk of cognitive impairment may be dependent on the severity of the hearing loss and the use of hearing aids does not significantly lower the risk for cognitive impairment in elderly individuals.⁷⁰ Another study by the Mayo Clinic (Study of Aging) tested 5,000 participants with and without hearing difficulties in different areas: memory, attention or executive function, language, and visuospatial skills.⁷¹ The results suggest that participants with hearing difficulties have greater odds of having mild cognitive impairment than participants without hearing difficulties.⁷¹

The mechanisms by which ARHL increases the risk for cognitive impairment are still being studied. Some experts believe that social isolation and loneliness may play an important role in ARHL and the development of cognitive impairment.^{68,69} Hearing loss may make it more difficult for individuals to communicate with others and impacts the ability to maintain relationships, resulting in a loss of auditory stimulation.^{68,69}

Sleep disordered breathing: More recent evidence is linking sleep disturbances to neurodegenerative diseases, including cognitive impairment and dementia.⁷² Among people with dementia, sleep disorders can be a predictor of poorer outcomes and poorer quality of life.⁷² An analysis of several peer reviewed papers on the topic finds that individuals with sleep disordered breathing (SDB) are 26% more likely to develop cognitive impairment.⁷³

The most common sleep disordered breathing condition is obstructive sleep apnea (OSA), a condition in which the partial collapse of the upper airway occurs during sleeping, resulting in frequent awakening or gasping during sleep. Almost one-third of people in Canada (30%) have an intermediate or high risk for sleep apnea, and among those 60 to 79, this risk rises to 50%.⁷⁴ Having OSA may lead to a reduction in blood flow to certain areas of the brain (hypoperfusion) and neural damage.⁷⁵ OSA and depression often have overlapping symptoms, resulting in many individuals being treated for depression, while OSA is overlooked and undiagnosed.⁷⁵

Heart-brain conditions and vulnerable populations

WOMEN

Heart disease and stroke are leading causes of premature death for women in Canada,¹³ claiming 32,000 lives in 2017.³⁷ In fact, 45% more women die of stroke than men¹⁴ and because women live longer, more women are living with the effects of stroke.¹⁵ Women with atrial fibrillation also have a higher risk for stroke, cardiovascular mortality and heart failure than men with atrial fibrillation.⁷⁶

Unfortunately, the presence of heart disease and stroke in women puts them at a greater risk for vascular cognitive impairment in later life. A Heart & Stroke analysis of Statistics Canada data found that in 2017, more women died of vascular cognitive impairment than men. A dementia diagnosis is also more likely in women than men.¹⁶ While the numbers tell a worrying story, the research in this area is lacking, and there are still many unknowns as to why women are more impacted by vascular cognitive impairment.

Women and men can have physiological differences and experience diseases differently, for example, the signs of heart attack can vary and may be different for men and women.⁴⁶ Diseases can manifest differently in women, and therapies and interventions that work for men can be ineffectual or even dangerous for women.^{77,78} While improvements in research funding requirements are leading to more women-focused research, one-fifth of non-sex specific cardiovascular studies still fail to enroll women.^{79,80} These shortcomings in research can impact the level of care women receive.

A Heart & Stroke needs assessment performed between September 2018 to May 2019 explored the needs of women and caregivers with lived experience of heart disease and/or stroke in Canada. A total of 204 women from across Canada participated in 18 in-person sessions to share their experiences. Many women reported challenges navigating the healthcare system, including receiving an initial diagnosis and subsequent care. Gender was recognized as a barrier to care and recovery and women felt this bias was often compounded

by their age, race, and other characteristics. Women highlighted the need for gender-specific supports, information, and resources throughout the entire continuum of care, including after discharge. The needs assessment highlights the importance of giving women with lived experience voices to advocate for themselves and having them involved in care conversations from the beginning.

INDIGENOUS COMMUNITIES

Indigenous populations in Canada have a heavier burden of chronic conditions when compared with the general Canadian population.¹⁷ Almost two-thirds of First Nations people have at least one chronic condition, in the general Canadian population half have at least one chronic condition.¹⁷ First Nations women have a higher burden of illness, with 67% reporting at least one chronic condition compared with 58% of First Nations men.¹⁷ The higher burden of chronic illness borne by Indigenous peoples in Canada also puts them at an increased risk for vascular cognitive impairment and related dementias.¹⁸ A review of Canadian research found that the prevalence of dementia in Indigenous populations is higher than in non-Indigenous populations.^{18,19}

Modifiable factors such as physical inactivity, lack of education, low quality nutrition and smoking play a role in increasing the risk for or exacerbating existing chronic illness that increase the risk for vascular cognitive impairment and related dementias.⁸¹ The effects of these determinants of health are disproportionately experienced by Indigenous people in Canada, linked to the historical role of colonization in disrupting traditional lifestyles, the lasting effects of intergenerational trauma from forced assimilation, and dispossession of communities from their traditional lands.⁸¹ These constrictions lead to the loss of social traditions, physically active lifestyles and knowledge of traditional diets.⁸¹ Resource constraints associated with living on reserves, especially in remote locations, leave many Indigenous peoples without the necessities to live a healthy lifestyle (e.g., recreation facilities, safe sidewalks and roads, affordable and traditional foods).⁸¹

There is a growing call for culturally safe care by Indigenous peoples in Canada, as culturally unsafe care can lead to a reluctance for individuals to visit healthcare facilities and can result in an alienating and disheartening care experience.⁸² When surveyed, 13.2% of First Nations felt that healthcare services were not culturally appropriate, and 11.8% expressed difficulties getting traditional care when needed.⁸³

Culturally safe care can be delivered through a practice called “two-eyed seeing”, which is the unification of Western medical care with traditional Indigenous medicine.²⁰ Through “two-eyed seeing”, healthcare providers can acknowledge the power imbalance between the provider and receiver of care, and the

role the provider plays in contributing to culturally safe care.²⁰ Dementia in Indigenous populations is often underdiagnosed⁸¹ and some care providers may fail to understand differing cultural views on aging and memory loss. Many Indigenous cultures view memory loss as a natural part of the life cycle, and the failure to recall memories is seen as the memories being “buried” temporarily, rather than lost forever.²⁰ Spiritually, the loss of memories is also associated with the experience of a second childhood as the person “returns to the Creator”.²⁰ Traditional languages often lack a specific word for dementia making the presence of dementia and related symptoms difficult to express.²⁰

Dementia, a relatively new phenomenon in Indigenous communities, was identified by Indigenous communities as an emerging health priority in 2007.²⁰ Rural and remote Indigenous communities need to build capacity for culturally safe dementia care by ensuring geriatric specialists in these communities are equipped to handle dementia in a culturally safe way. There is also a need for national level survey tools to assess the growing prevalence of vascular cognitive impairment and related dementias among Indigenous populations.¹⁹

The social and cultural determinants of health, modifiable risk factors, and cognitive impairment

Social and cultural determinants of health are among the many factors that influence how individuals live (e.g., income, education, housing, diet, culture, and physical and social environments) and play a key role in disease onset, care, recovery, and long-term management. The social and cultural determinants of health are interconnected and some determinants such as income and housing, can have a ripple effect, impacting the health of current and future generations.

In 2017, the Lancet Commission on Dementia published a report which highlighted nine potentially modifiable risk factors for dementia, many of which are important social and cultural determinants of health. Building on the 2017 paper, the Commission released an update in 2020 which added three more modifiable risks. The twelve risks – education, hearing loss, traumatic brain injury, hypertension, alcohol consumption, obesity, smoking, depression, social isolation, physical inactivity, air pollution and diabetes – account for 40% of dementia worldwide according to the report.²¹ Addressing these modifiable factors in early life, midlife, and later life (and considering the role of social and cultural determinants of health) can reduce the risk of future dementia.

PHYSICAL INACTIVITY

Physical inactivity is a major risk factor for heart disease and stroke, contributing to most other modifiable risk factors, including diabetes, obesity and hypertension.⁸⁴ Physical activity

contributes significantly to psychological wellbeing and plays an important role in stress management. It can also protect individuals from cognitive impairment and vascular dementia in later life.²² A meta-analysis by Colcombe and Kramer (2003) found that intensive and long-term physical activity (> 30 minutes), such as strength training in combination with aerobic training, were more likely to improve cognitive function among older adults.⁸⁵ Other research supports the effectiveness of high levels of physical activity on cognitive decline compared to low-to-moderate levels of physical activity.^{86,87}

In Canada, physical activity levels are lower than the recommended standard.⁸⁸ The Canadian Society for Exercise Physiology (CSEP) guidelines recommend adults 18 and older get at least 150 minutes of moderate to vigorous aerobic physical activity per week.⁸⁹ Many factors can influence the physical activity levels of an individual including the environments people live and work in. Older adults are more likely to partake in physical activity if their neighbourhoods are safe, walkable, aesthetically pleasing, and destinations and services are easily accessible.²³ In one study, the presence of sidewalks and recreational facilities greatly improved activity post-stroke, measured by average number of steps taken.⁹⁰

NUTRITION

Many pre-disposing risks for dementia (such as heart disease, hypertension, obesity and diabetes) are also closely linked to nutrition.^{91,92} Mediterranean-style diets, which constitute a high consumption of vegetables, fruits, legumes, whole grain foods, and healthy unsaturated fats from nuts, seeds, and vegetable oils (especially olive oil), along with moderate consumption of fish, poultry, eggs and dairy and low consumption of meat and sweets,⁹³ are associated with a decreased risk for cognitive decline.^{94,95} A randomized control study performed in Spain on individuals with cardiovascular disease, diabetes and other major risk factors found study participants in the group consuming Mediterranean diets supplemented with olive oil had a significantly reduced risk for mild cognitive impairment than other participants.²⁴

Unfortunately, 12.7% of households in Canada are impacted by food insecurity.^{91,96} Of those impacted, 41.6% could not afford to eat balanced meals and 12.5% relied on a few low-cost foods to feed their children.⁹⁶ Food insecurity is closely linked with socioeconomic status, which is often determined by income, education and housing. Women, Indigenous peoples, African Americans and recent immigrants are more severely impacted by food insecurity than the general population.^{83,91,96}

EDUCATION

Low educational attainment is also an independent risk factor for vascular cognitive impairment. One meta-analysis found that among people who experienced a stroke, having more years of formal education lowered the risk for cognitive

decline and a clinical diagnosis of vascular cognitive impairment compared with having fewer years of formal education.²⁵ In another study, the risk of dementia among people who experienced a stroke was highest among those with low education, followed by those with intermediate education.⁹⁷ Individuals with high education levels had the lowest risk for a dementia diagnosis following stroke.⁹⁷

SMOKING

Economically vulnerable populations, in addition to being impacted by food insecurity, are also more vulnerable to smoking.^{26,27} These populations bear a disproportionate share of the burden of death, illness and diseases caused by tobacco.^{26,27} Smoking can impair the vascular system in the body by damaging blood vessels.⁹⁸ The stiffening and narrowing of the blood vessels can have dire consequences and manifest in diseases like coronary artery disease or stroke.⁹⁸ The risk for stroke especially is two to four times greater among smokers than among those who do not smoke.⁹⁸ Smoking is an independent risk factor for vascular dementia. Population level research studying the impacts of smoking on vascular dementia finds a positive association between smoking and the risk of vascular dementia.²⁸⁻³⁰ This risk increases for long-term smokers, while in comparison, non-smokers and long-term quitters have a reduced risk for vascular dementia.²⁸⁻³⁰

ACCESS TO PRESCRIPTION MEDICATION

A growing concern among Canadians is the inequitable access to drugs in Canada that disproportionately affects lower income population groups, such as women and Indigenous peoples.⁹⁹ Those with lower income levels have higher out-of-pocket costs for prescription medications than higher income households.¹⁰⁰ Costs can prevent individuals from complying with medication dosing as prescribed, and this affects between 8 to 10% of people in Canada.¹⁰¹⁻¹⁰³ Improper adherence to medications can result in mortality and increased hospitalizations and healthcare costs.^{104,105}

SOLUTIONS

Interventions, whether prevention or treatment focused, should consider the person as a whole. A multi-faceted approach to targeting the pre-disposing risks factors of cognitive impairment is a promising treatment modality and has been shown to be effective in a randomized control trial performed over two years in Finland. Several intervention were delivered to the experimental group in the FINGER trial.¹⁰⁶ Diets and physical activity were tailored according to participant needs by nutritionists and physiotherapists. The cognitive training intervention included computer-based activities to address memory and mental speed and was delivered by psychologists. The numerous intervention

meetings also stimulated social activity among participants. When assessed after 24 months, the experimental group had an 83% higher improvement in executive functioning and a 150% higher improvement in processing speed. There were also improvements in dietary habits, physical activity and body mass index (BMI).¹⁰⁶

However, strategies for addressing vascular cognitive impairment need to extend beyond treatment, to upstream preventative approaches. Governments can play a unique role in addressing the pre-disposing risks of vascular cognitive impairment through a combination of health promotion, policy, and funding initiatives.

Health promotion to raise awareness of dietary risk factors and improved access to foods low in salt, sugar and saturated fat can help Canadian families make healthier food choices for improved overall wellness. A range of short- and long-term solutions can help, including policies to reduce or limit salt, sugar and saturated fat in food and beverages, the restrictions on the marketing of unhealthy food and beverages to children, pricing policies that encourage vegetable and fruit consumption, and community-based programs that improve access to nourishing, culturally appropriate food.

Health practitioners can work with people who smoke to highlight the different risks associated with long-term smoking including dementia, and the magnification of this risk in the presence of other chronic conditions. Patients and providers could work together to achieve complete cessation according to their individual needs. Governments could continue to support policies that aim to reduce the burden of smoking in the Canadian population, including reducing retail access to tobacco products, increasing tobacco taxes, and updating large rotating health warnings.

While the ideal situation would be for people in Canada to engage in regular physical activity, this is not always possible. Financial barriers can prevent adults and children from participating in fitness activities, as can the lack of recreational facilities and active transportation infrastructure in communities. Governments need to ensure continued investments in programs, facilities and infrastructure which provide people in Canada with low-cost physical activity options, such as parks, walking paths, bike trails, community centers and sports fields.

Governments also need to invest in affordable housing strategies and the creation of safe communities as many people in Canada, especially Indigenous peoples, report living in dwellings or communities that do not suitably meet their needs. Recognizing the importance of built environments and the role they play in preventing chronic disease (including heart and brain conditions) is an important aspect of community planning. The Dementia Friendly Canada

project, a joint project between the Alzheimer Society of Canada and the Alzheimer Societies of BC, Saskatchewan, Manitoba and Ontario, is committed to empowering people living with dementia through the building of dementia friendly communities. This includes wide clutter-free sidewalks, large and legible signage, and the use of contrasting colours in public spaces so objects like toilets in public bathrooms are easily distinguishable from a distance.¹⁰⁷ These community initiatives support people with dementia and their caregivers to live independently and safely navigate and access their local businesses, facilities and services.¹⁰⁷

Dementia friendly communities also enable socialization. Frequent participation in social activities by seniors leads to more positive reporting on perceived health, and lower feelings of loneliness or dissatisfaction with life.¹⁰⁸ Research into the impacts of loneliness and the lack of social support suggests social isolation and loneliness may increase the risk for chronic conditions, including vascular cognitive impairment. Loneliness is associated with the triggering of certain pathways in the body that activate the body's stress response.¹⁰⁹ According to one study, poor social relationships are associated with a 29% increase in risk of coronary heart disease and a 32% increase in risk of stroke.¹¹⁰ An analysis of several studies exploring the link between loneliness, social isolation and dementia finds that individuals who report more feelings of loneliness and have lower levels of social participation or engagement, are at an increased risk of developing dementia.³¹⁻³³ On the other hand, having good levels of social engagement and interaction is protective against the development of dementia.³³

Using both upstream and downstream solutions to address the burden of vascular cognitive impairment and related dementias in the population is a holistic approach that considers the person as a whole and accounts for environmental and physical factors that influence health. This holistic approach to care should be delivered in a way that is also culturally sensitive for all people in Canada.

Living with or caring for someone with vascular cognitive impairment

Living with vascular cognitive impairment can be challenging. Vascular cognitive impairment can affect how individuals communicate with others, making it difficult to express thoughts or feelings and maintain personal relationships. The stigma associated with cognitive conditions may also prevent individuals living with vascular cognitive impairment from reaching out to support networks, further isolating them from their family and friends. Oftentimes, individuals living with vascular cognitive impairment may have a difficult time accepting the cognitive deficits they are experiencing. This can result in feelings of shame and inadequacy due to their inability to control certain aspects of their life.

In June 2016, federal legislation was passed allowing eligible adults access to medical assistance in dying (MAID) in Canada.¹¹¹ However, in order to be eligible, the individual requesting MAID must give informed consent at the time of their request and “immediately before medical assistance in dying is provided”.¹¹¹ For those with vascular cognitive impairment, providing consent before MAID occurs may be impossible due to the loss of decision-making capacity in the advanced stages of the disease. Over 300,000 people in Canada responded to government consultations on MAID in January and February 2020.¹¹² A large majority voiced support for changes to MAID legislation to include advanced requests for MAID.¹¹² An advanced request for MAID can be made before any loss of decision-making capacity, with the intent that the request be carried out in the future. For many, the issue of MAID constitutes a question of dignity and having control over one’s own end-of-life planning.

Caregiving for someone with vascular cognitive impairment can be a significant commitment, both financially and emotionally. Regardless of whether the caregiving is occurring in the home or in a facility, the responsibility of caregiving can lead to caregiver stress and fatigue. A German study found that nursing staff caring for people with cognitive impairment reported more care challenges as the cognitive impairment worsened. Nurses caring for cognitively unimpaired individuals reported an average of 0.41 care challenges per hospital stay, such as patients wandering or being physically aggressive, while nurses caring for individuals with severe dementia reported 5.04 care challenges.¹¹³

Informal caregiving for people living with vascular cognitive impairment, requires a significant time investment of an estimated 81.4 hours per month.³⁴ This can increase to 111.4 hours per month when caring for individuals with severe cognitive impairment.³⁴ Women take on the majority of caregiving duties, one study estimates 75% of caregiving is provided by females.³⁴ Many caregivers are still working while providing care, which can be especially difficult for those working full-time. In addition to the cost of forgone labour, there are also travel costs, medication costs and healthcare service costs associated with caregiving.

In a study performed in the Netherlands, informal caregivers of someone with cognitive impairment were five times more likely to report caregiving problems than caregivers caring for someone without cognitive impairment.¹¹⁴ A Portuguese study on caregivers of people with cognitive impairment highlighted the need of caregivers to have access to better information and support from the primary care provider.¹¹⁵ Caregivers felt distressed by their low levels of knowledge about caring for someone with dementia and singled out primary care providers as trusted sources of medical and caregiving information.¹¹⁵ A randomized control trial conducted in a

University hospital in China found that stroke care education targeted at the primary family caregiver reduced anxiety, depression and had a measurable impact on cognitive decline among individuals who has experienced an ischemic stroke.¹¹⁶

Strategies and practices in Canada and globally

Canada

FEDERAL ACTIONS

The National Strategy for Alzheimer’s Disease and Other Dementias Act (Bill C-233), that passed in June 2017, required Canada to develop a national dementia strategy.¹¹⁷ *A Dementia Strategy for Canada: Together we Aspire*, led by the Public Health Agency of Canada, was developed and released in June 2019.¹¹⁷ The strategy encompasses dementia and its various subtypes (including vascular dementia) and includes three objectives: 1) to prevent dementia, 2) to advance therapies and find a cure, and 3) to improve the quality of life of people living with dementia and caregivers.¹¹⁷ To achieve these objectives, the strategy calls for multi-partner collaboration, investments in research and innovation, comprehensive surveillance and data, information resources, and the building of a skilled workforce through post-secondary training.¹¹⁷ Specifically, social and built environments need to support people in Canada of all ages to adopt healthy lifestyles, and to foster safe and supportive environments for people living with dementia and their caregivers.¹¹⁷

The federal government’s 2019 budget included \$50 million in funding over five years to implement Canada’s dementia strategy.¹¹⁸ However, the dementia strategy recommends a benchmark annual investment that exceeds 1% of the total cost of dementia care. To that end, an estimated \$100 million in funding annually would be the minimum needed to reach the strategy’s goals and objectives.¹¹⁹

Bill C-233 requires that the Minister of Health provide an annual report on Canada’s dementia strategy within two years of the bill’s enactment, and every year thereafter. The report is meant to discuss the effectiveness of the national strategy and provide additional recommendations,¹¹⁷ and although Bill C-233 passed in 2017, the first report has not been released. It is essential that this work continues, and the federal government remains committed to ongoing monitoring and evaluation of the strategy.

The Canadian Institutes of Health Research (CIHR)

The Canadian Institute of Health Research (CIHR) is Canada’s largest federal funding agency for health research.¹²⁰ The institute supports research on neurodegenerative diseases that lead to dementia. Between 2013-14 and 2017-18 CIHR invested nearly \$200 million in dementia-related research

in a variety of areas including population and public health research, in order to better understand how social, cultural, and environmental aspects influence dementia.¹¹⁷ Currently, CIHR is conducting Canada-wide consultations on priorities areas for their *Dementia Research* Strategy investments.

The Canadian Consortium on Neurodegeneration and Aging (CCNA)

The government of Canada, the Alzheimer Society, the Canadian Nurses Foundation and several other organizations assist with funding the Canadian Consortium on Neurodegeneration and Aging (CCNA) through the CIHR.¹¹⁷ The CCNA is Canada's first and foremost nation-wide research enterprise on neurodegenerative diseases, with a team dedicated to researching how vascular conditions impact neurodegenerative diseases.¹²¹ In 2021, CCNA published [new guidelines for the management of vascular cognitive impairment](#). Overall, the CCNA aims to increase understanding around how neurodegenerative diseases develop, how to slow and ultimately prevent dementia, and the impact dementia has on individuals, their families, and the community.¹²²

Public Health Agency of Canada (PHAC)

The Public Health Agency of Canada (PHAC), a federal government body, is involved in many different dementia-related projects.¹²³ PHAC supports the Canadian Chronic Disease Surveillance System (CCDSS), a collaborative network which collects provincial chronic disease information.¹²⁴ This information helps determine resource allocation, and the development of health policies and programs.¹⁴⁹ The data is also used in national reporting estimates of chronic disease incidence, prevalence, all-cause mortality, and other metrics.¹²⁴ The CCDSS collects dementia data from physician billing claims, hospital databases, and prescription drug records.¹²⁴ CCDSS dementia data for Alzheimer's disease, vascular dementia and other dementia subtypes is often presented in aggregate. Data pooling can create challenges when trying to understand the specific impact of vascular dementia on people in Canada.¹²⁴

PHAC is involved with and funds many other dementia initiatives including the Centre for Aging + Brain Health Innovation, which received a \$42 million investment from PHAC.¹¹⁷ PHAC, through their healthy living and chronic disease prevention multi-sectoral partnerships program, also leads the development of new chronic disease prevention ideas, and interventions.^{117,125} The program has invested upwards of \$200 million in funding, including funding from non-governmental partners since 2013.¹¹⁷ The program focuses on addressing modifiable risk factors, such as physical inactivity and unhealthy diets, which are lifestyle behaviors that may increase the risk for heart and brain diseases.^{117,125}

PROVINCIAL AND TERRITORIAL STRATEGIES

Nova Scotia, British Columbia, Alberta, Manitoba, and Quebec currently have existing dementia strategies in place.¹²⁶ Ontario, New Brunswick, and Newfoundland and Labrador are in the process of developing strategies while Saskatchewan, Prince Edward Island, Yukon, Northwest Territories, and Nunavut have no official strategy but instead offer programs and services for people living with dementia and their caregivers.^{117,126,127}

In 2012, Alberta launched the Cardiovascular Health and Stroke Strategic Clinical Network (CvHS SCN), a province wide team of healthcare professionals, researchers, community leaders, policy makers and people living with disease who aim to improve prevention, treatment and management of vascular diseases. Initiatives by the CvHS SCN include the vascular risk reduction program, which is a series of projects with a primary aim of identifying people in the community at risk of vascular diseases. The program has two main components: 1) vascular risk factor screening, case finding and early management and b) integrated vascular risk reduction clinics (i.e., by consolidating secondary prevention services such as hypertension, dyslipidemia, stroke prevention and cardiac rehabilitation services). So far, over 30 primary care organizations and more than 400 family physicians are participating, reaching over 450,000 Albertans.

In 2017, the five-year Alberta Dementia Strategy and Action Plan was released, with a focus on brain health, supporting people living with dementia and their caregivers in their communities, and providing high quality care and services from diagnosis through to end-of-life.¹²⁸ Alberta's strategy was developed in consultation and collaboration with the public, those living with dementia, caregivers, front-line organizations, and healthcare workers.^{117,128} Some of the investments made include \$4.1 million towards Seniors Health Strategic Clinical Network and \$1.98 million to expand the *FirstLink^R Program*, which helps connect patients who receive a dementia diagnosis with the services they need.^{117,129} The total cost and available funding have not been disclosed, and it has been criticized for lacking cost projections and a failure by the government to commit to further funding.¹³⁰

Provinces and territories that do not have an official dementia strategy do have some government-funded dementia initiatives similar to regions that have an action plan or strategy.¹¹⁷ Common programs or services include the *FirstLink^R Program*, dementia care units in long-term care homes, training programs, age-friendly communities, and campaigns to increase dementia awareness.¹¹⁷ While these programs play an important role in addressing some gaps in care for people with dementia, more comprehensive and over-arching strategies are needed in provinces to complement the federal dementia strategy and to address the growing needs of an aging population.

STRATEGIES FOR INDIGENOUS COMMUNITIES

CIHR funded two Indigenous focused projects in 2017 as part of their *Dementia Research Strategy*.¹³¹ The investment totaled \$1 million, half of which was allocated towards a project for culturally sensitive dementia care for older Indigenous peoples with dementia.¹³¹ The other half of the funding was allocated towards the development of the Canadian Indigenous Cognitive Assessment Tool for widespread screening, and to provide a foundation for a national study of dementia in Indigenous populations.¹³¹ The Canadian Indigenous Cognitive Assessment Tool has been validated with the Anishinaabek people on Manitoulin Island and ongoing work is being conducted to translate the tool and validate it within other Indigenous communities.¹³²

The CCNA is working collaboratively with Indigenous communities as part of their *Indigenous Cognitive Health* program. The program proposes to support Indigenous-led dementia research through training and capacity building, curate resources to help CCNA researchers conduct culturally safe dementia research and develop a policy on Indigenous Data Access.¹³³

Indigenous Services Canada offers an assisted living program that First Nations can apply for to receive annual funding to provide non-medical, assisted living services to eligible individuals.¹³⁴ First Nations living in Northwest Territories and Nunavut are excluded from this service as they are covered by their territorial governments.¹³⁴ Eligibility is limited to individuals who live on-reserve, have been referred by a healthcare provider, and cannot access these services or supports by any other means.¹³⁴ These requirements can be a barrier to access for many Indigenous communities who live in areas eligible for service.

The *First Nations Inuit Home and Community Care Program* is also available to eligible First Nations and Inuit people with chronic illness, including vascular cognitive impairment and vascular dementia, who need nursing and personal care.¹³⁵ Approximately \$142 million has been invested into this community care program between 2017-2018.¹³⁵

While these programs and services contribute towards much needed investments in Indigenous communities, they are not enough. The federal government should continue to invest more in dementia-related initiatives, including population level surveillance to determine the burden of vascular cognitive impairment and vascular dementia in Indigenous communities. Investments in research should be made to understand the specific risks Indigenous populations have, and for the development of interventions that are culturally safe and effective.

Globally

In 2013, the world's first G8 dementia summit was held where attendees called upon the World Health Organization (WHO) to recognize dementia as a global health threat requiring immediate action.¹³⁶ Following this call to action, the WHO proceeded to host the first Global Action Against Dementia WHO Ministerial Conference in 2015.¹³⁷ Two years later, the World Health Organization released their *Global Action Plan on the Public Health Response to Dementia 2017 – 2025* in an effort to improve the lives of people living with dementia, their families, and caregivers, while reducing the impact of dementia on participating communities and countries.¹³⁸ As of 2019, 31 dementia plans have been adopted worldwide across 28 countries, 26 of which are members of the WHO.¹³⁹ This is only 18% of the WHO target of 146 countries.¹³⁹

The WHO also released a report titled *Risk reduction of cognitive decline and dementia guidelines* in 2019 in an effort to promote prevention strategies.¹⁴⁰ The InterAcademy Partnership and Alzheimer Disease International have also released reports that share common themes, such as the importance of creating healthy environments that facilitate risk reduction, continuity of care, funding dementia research, and providing support to caregivers.^{141,142} While Alzheimer's and vascular dementia are two separate diseases, Alzheimer societies around the world are key proponents for dementia-related initiatives and have launched several programs and services. For example, the Alzheimer Society UK released a document in 2013 titled *Building dementia friendly communities: A priority for everyone*.

Gaps in care and an integrated care model

In Canada, the burden of chronic illnesses is growing, affecting older people, as well as younger people. Both face distinct challenges due to the impact that chronic illness can have on areas including employment, family, socialization, and daily life. Canadian hospital data finds that more than two-thirds of people in Canada aged 65 and over have at least one chronic condition.¹⁴³ Adults that are 65 and older are twice as likely to have three or more chronic conditions compared with adults 45 to 64.¹⁴³ Those with a greater burden of chronic diseases also require more services from primary health care clinics than those with no or fewer chronic diseases. Older individuals and females are more likely to be high service users of primary health care clinics as well.¹⁴³

For people with cognitive impairment, the challenge to provide care can be greater. An analysis of Ontario's OHIP data from 2008 found that individuals diagnosed with dementia saw a general practitioner approximately 12 times a year and a specialist approximately 13 times a year.³⁶

Unfortunately, Canada's healthcare system is not set up to deal with the complexities that arise with caring for multiple chronic conditions. Data from the Commonwealth Fund's 2017 International Health Policy Survey of Seniors found that almost two thirds of seniors had difficulty accessing medical care after hours without going to an emergency department.¹⁴⁴ Many seniors faced some form of coordination problem. About 12% of seniors said medical test results were unavailable at their appointment, 11% also reported receiving conflicting information from various healthcare providers, and 8% felt a mistake had been made during their treatment.¹⁴⁴ Many seniors also had difficulties accessing care from specialists, with three out of five seniors waiting at least four weeks for an appointment.¹⁴⁴ Seniors also noted a lack of communication between their regular care provider and their specialists.¹⁴⁴ This siloed approach to care can be difficult when seeking diagnosis, treatment and recovery, putting heavy demands on primary care providers to coordinate care in a complex system.

Oftentimes, the need for complex care continues even after people living with chronic conditions are discharged from the hospital. One in five seniors report not receiving instructions following discharge nor on how follow-up care can be arranged.¹⁴⁴ More than a quarter (27%) also report receiving no information on the medications they are prescribed, including on the purpose of the medications.¹⁴⁴

Many seniors who remain in their homes as they age receive care from informal caregivers (family, friends or neighbors).¹⁴⁵ The presence of cognitive impairment can add to the complexity of care needed, and can be a source of distress for the caregiver.¹⁴⁵ In addition, the experience of vascular cognitive impairment can also be impacted by factors such as life stage and one's roles and responsibilities including employment, family roles and personal or professional responsibilities. These may create unique challenges, especially for those experiencing vascular cognitive impairment at a younger age.

WHAT DOES AN INTEGRATED CARE MODEL LOOK LIKE?

A properly integrated care model would provide seamless care for patients from diagnosis to recovery, and transition back into the community. Such an approach in the Canadian healthcare system would require strong foundations in primary health care and extensive collaboration and communication between numerous health professionals and health systems planners. A steering committee formed by the Canadian Nurses Association and Canadian Medical Association in 2012 discussed transforming the Canadian healthcare system into a more integrated model. From the discussions, five foundational principles emerged:

Patient access:¹⁴⁶ All people in Canada can benefit from equitable access to comprehensive care regardless of barriers, including geographic location. This includes equitable access to prescription medications irrespective of financial situation.

Patient-centered care:¹⁴⁶ Health care providers should ensure care is customized to individual needs and can be changed as the needs of the individual changes. This includes empowering patients to manage their care needs while also providing safe and culturally appropriate care.

Informational Continuity:¹⁴⁶ Care can be properly transitioned from one provider to the next if there is easy access to information and data sharing. Proper linkages to the most updated patient care information (i.e., by sharing of electronic medical records) can ensure the care provided is not duplicative and satisfies patient needs.

Management Continuity:¹⁴⁶ Care services and supports require coordination across sectors and geographic regions. For patients with chronic conditions, continuity of care services means regular contact between healthcare providers to ensure patient goals are being met or adapted.

Relational Continuity:¹⁴⁶ Patient discharge planning is an integrated effort and should include caregivers and patients. Care continues into the community. Healthcare providers should refer patients to community services and programs and maintain regular contact with patients and caregivers.

Integrated stroke care and vascular cognitive impairment

A study which conducted semi-structured interviews with primary and secondary care providers found several barriers to providing integrated care for people experiencing memory deficits following stroke. Care providers found that there was less of a focus on memory and cognitive deficits post-stroke, and limited communication of care difficulties following discharge of people who have had a stroke into the community.¹⁴⁷ Providers also felt that there was a lack of clear role distinction between primary and secondary care providers leading to gaps in information sharing and poorly optimized care pathways.¹⁴⁷

The Canadian Stroke Best Practice guidelines on vascular cognitive impairment lays out how these gaps can be addressed. People who have had a stroke should be routinely screened for vascular cognitive impairment symptoms at and after hospital discharge and at transition points.³⁵ This includes screening prior to discharge from acute care, during inpatient rehabilitation, and during post-stroke outpatient and community care. For people living with the effects of stroke and vascular cognitive impairment, further assessments are recommended to measure impairments in areas such as arousal, attention, memory, and language. The impact and presentation of vascular cognitive impairment can change over time; thus, it is recommended that screening and assessment take place at different stages of care.

In order to reduce the risk for vascular cognitive impairment following stroke, the risk factors for cognitive impairment such as hypertension and diabetes should be managed. It

is important that these interventions are tailored to the needs of the individual and account for individual goals, strengths, and expectations. For people who have had a stroke and are showing signs of depression or anxiety, a referral should be made to the appropriate mental healthcare professionals. Cognitive rehabilitation interventions for vascular cognitive impairment following stroke should focus on deficits in memory, attention, and/or executive function, with the objective to either reinforce or re-establish previous skills or to teach compensatory skills. Computer-based gaming, physical activity, virtual reality, and music listening have all shown some success in cognitive rehabilitation.

Virtual care and vascular cognitive impairment

Virtual healthcare is a healthcare session between a healthcare provider and a person with a health issue, which takes place with each person in a different location, like a home or clinic. It uses technology to connect them – such as by phone or computer with or without videoconferencing. The COVID-19 pandemic has fast tracked the adoption of virtual healthcare in Canada, and as the delivery of services through virtual methods becomes increasingly popular, research is turning towards how virtual health can support people living with chronic diseases, including heart and brain conditions.

Early research suggests some healthcare can be delivered virtually to people living with dementia with positive results. A 2018 study of 82 individuals aged 60-75 years old, looked at whether virtual healthcare addressing lifestyle behaviors could improve participants diet, exercise, sleep, stress, and cognition. Many different digital platforms were used to facilitate the year-long virtual healthcare intervention. A coach was available at regular intervals via telephone and email, and a web-based guide was also provided to participants. The lifestyle interventions appeared to improve participants cognitive function, which may be beneficial in delaying or preventing the onset of dementia.¹⁴⁸

Another comprehensive review assessed the benefits of providing telephone and internet support to caregivers of people living with cognitive impairment such as vascular dementia, mixed dementia, and Alzheimer's dementia.¹⁴⁹ Supports that were provided virtually included social support, therapy or counselling for mental health concerns or disorders, and education. Caregivers who received virtual healthcare through both the telephone and the internet experienced better outcomes than caregivers receiving services through either the telephone or internet alone. The outcomes included: a reduction in depression and perceived care burden, and an increase in self-efficacy.

To better implement effective virtual healthcare, more research is required to understand the specific care gaps that need to be filled for people living with vascular cognitive impairment and their caregivers.¹⁴⁹ Considerations need to be made for communities that face barriers accessing virtual healthcare including seniors, low-income earners, northern, remote and rural communities, newcomers, Indigenous peoples, people with disabilities, people experiencing homelessness and those with low literacy levels.

Gaps in research and priority areas

At present, there are limited pharmacological treatments approved for vascular cognitive impairment, and the effectiveness of other alternative treatments is still being researched. Stroke is increasingly recognized as an important risk factor for vascular cognitive impairment. Research is helping healthcare providers understand the mechanisms that link stroke and other cerebrovascular diseases to cognitive impairment and vascular dementia. There is limited knowledge around how treatments targeting comorbid conditions associated with vascular cognitive impairment can influence the risk of developing vascular cognitive impairment or reduce its severity. More clinical trials are needed to assess the effectiveness of both new pharmacological and nonpharmacological treatments, including treatments which consider the social domains of health and well-being of both patient and caregiver.

The First WHO Ministerial Conference on Global Action Against Dementia was held in March 2015. Over 160 delegates in attendance agreed on a call for action to reduce the global burden of dementia through a collaborative global effort in dementia research.¹⁵⁰ Following this call for action, a ranking process was undertaken by 162 experts (of which 88% were researchers or clinicians) from 39 countries (predominantly America [36%], Europe [37%] and the western Pacific [17%]).¹⁵⁰ From this process, seven research domains emerged as priority areas of focus to reduce the global burden of dementia by 2025:

1. Prevention, identification, and reduction of risk:¹⁵⁰

Explore approaches to primary and secondary prevention of dementias based on risk and protective factors. Understand the interactions and interplay between modifiable, non-modifiable, risk and protective factors for dementia. Determine the feasibility and effectiveness of interventions that address risk factors for dementia such as physical activity, nutrition, and education, etc.

2. Quality of care for people with dementia and their caregivers:¹⁵⁰

Explore optimal interventions for education, training and support of informal community caregivers of individuals with dementia. Develop policies and plans to increase the knowledge, skills and capacity of the health and social care workforce in dementia care.

3. Delivery of care and services for people with dementia and their caregivers:¹⁵⁰ Perform research on the most optimal models of care and support for individuals with dementia and informal caregivers. Identify strategies to deliver cost-effective treatments and late- to end-of-life care for people with dementia. Understand the role assistive technology can play (e-health, mobile health etc.) for people with dementia and caregivers.

4. Diagnosis, biomarker development, and disease monitoring:¹⁵⁰ Identify clinical practices and interventions that would lead to an accurate and timely diagnosis of dementia. Develop and validate biomarkers for the causes of dementia, to assess disease progression from the pre-symptomatic stage to late stage. Establish surveillance of healthy individuals to detect the earliest changes in neurodegenerative diseases.

5. Pharmacological and non-pharmacological clinical-translational research:¹⁵⁰ Discover different therapeutic approaches through clinical trials for neurodegenerative and other brain diseases that cause dementia. Collaborate to explore more efficient trials, adaptive trials, and combination therapy for dementia. Apply better outcome measures for clinical trials of cognition, function, and other biomarkers for neurodegenerative diseases causing dementia.

6. Public awareness and understanding:¹⁵⁰ Determine how knowledge of modifiable and non-modifiable risks can be effectively translated into health promotion and prevention messages for dementia. Determine the effectiveness and cost-effectiveness of dementia-friendly communities and other strategies. Understand the cultural differences in attitudes towards dementia to promote culturally appropriate care.

7. Physiology and progression of normal ageing and disease pathogenesis:¹⁵⁰ Understand how vascular conditions (such as heart disease and stroke) contribute to the development of neurodegenerative diseases and dementias. Understand the role of inflammation and the immune system in the onset and progression of dementias.

Policy Options

Heart & Stroke recommends all people in Canada and sectors of Canadian society consider the following policy options to prevent vascular cognitive impairment and to improve patient outcomes, recognizing the tight connection between heart disease, stroke and vascular cognitive impairment.

1. People in Canada (including people with lived experience) and community-based organizations and programs:

- Learn more about heart disease, stroke and vascular cognitive impairment:
 - Heart & Stroke's webpage on [vascular cognitive impairment](#)
 - Heart & Stroke's 2019 [\(Dis\)connected report](#)
- Be an advocate: Get into contact with your local governments to advocate for healthy heart-brain policies and better awareness and prevention of vascular cognitive impairment
- Support and encourage government action to address environmental and social factors that impact health including support of:
 - Food programs, services and policies that increases access to nutritious foods
 - Dementia friendly community programs and infrastructure
 - Safe and affordable housing policies
 - Physical activity initiatives for children, adults and seniors
 - Tobacco control policies
- People with live experience (PWLE) of heart disease, stroke and/or vascular cognitive impairment:
 - Speak with your doctor about your specific risks for vascular cognitive impairment if you have heart disease and/or have had a stroke
 - If you have vascular cognitive impairment, speak with your doctor about ongoing management and what your expectations are
 - Understand that stigma can be a big inhibitor and barrier to acknowledging problems with cognition and seeking help
 - Speak with your family and friends about what it means to be living with vascular cognitive impairment and the supports that are needed
 - Voice your need for culturally safe care and speak with your care providers about how your unique needs can be better accommodated
- Live a healthy and active lifestyle:
 - Eat a nutritious and balanced diet of foods low in salt, sugar and saturated fat and make water the drink of choice
 - Engage in moderate to vigorous physical activity (whether it be walking, biking, jogging, or exercising) on a regular basis

- If you currently smoke, think about quitting and speak with your doctor about appropriate smoking cessation interventions
- Engage in regular social activities to the best of your ability and maintain social relationships
- Monitor signs, symptoms, or conditions that could be linked to vascular cognitive impairment such as communication or sensorimotor deficits (e.g., vision or hearing loss) and talk to your doctor if you experience these in everyday life.

Legend

F: Federal

P/T: Provincial & Territorial

M: Municipal

2. Governments at all levels:

- Keep informed about vascular cognitive impairment and the benefits of preventative action on overall health and wellness **(F, P/T, M)**
- Increase public awareness on prevention of vascular cognitive impairment by implementing health promotion campaigns with a focus on addressing important modifiable and non-modifiable risk factors (including diet, physical activity, smoking, diabetes, hypertension among others) **(F, P/T)**
- Increase public awareness on the risks associated with vascular cognitive impairment (such as an increased risk for stroke) by implementing awareness campaigns **(F, P/T)**
- Work in partnerships with Indigenous communities to seek out solutions to care gaps for Indigenous people with vascular cognitive impairment **(F, P/T)**
- Implement interventions to address modifiable risk factors:
 - Enable people in Canada to eat healthy balanced diets low in salt, sugar and saturated fats through measures like front-of-package nutrition labelling, restricting food and beverage marketing to children, implementing school food policies, and developing local programs and strategies to address access to healthy foods **(F, P/T, M)**
 - Implement and support policies and programs that strengthen tobacco control strategies, including increased taxation, retail licensing, increasing the legal age, enhancing smoke-free policies among other policy measures **(F, P/T, M)**
 - Implement and support policies and programs that support smoking cessation efforts **(P/T, M)**
 - Develop, implement and evaluate well-funded comprehensive strategies to support physical activity including by establishing funding for active transportation, increasing physical activity in schools, and creating infrastructure conducive to active lifestyles **(F, P/T, M)**
- Implement interventions to address the determinants of health:
 - Establish policies to reduce poverty and food insecurity, including measures that provide income assistance, foster the production and distribution of healthy foods, and provide short-term emergency relief from food insecurity **(F, P/T, M)**
 - Create communities that support active healthy living by ensuring communities have active infrastructure (sidewalks, bike paths, parks) and easy access to community centers, shops and services **(P/T, M)**
 - Provide incentives for community building health promotion and social activities (i.e., tax credits for group activities that promote social integration) **(F, P/T)**
 - Support housing policies that make safe housing more affordable for people in Canada with low income **(P/T, M)**
- Support and create dementia friendly communities to help people living with dementia better navigate their communities safely:
 - Implement brain and heart health friendly community initiatives such as walkable infrastructure, active transportation and areas people can be social **(M)**
 - Construct public spaces with contrasting colours for bathrooms, stairs, and handrails and ensure local signage appears in easily legible fonts **(M)**
 - Ensure communities have areas people can gather and be social. Offer social activities for seniors at community centers **(M)**
- Implement an equitable and universal pharmacare program, in which the public payer is the first payer, to improve access to cost-effective medicines for people in Canada, including those with heart disease, stroke or vascular cognitive impairment **(F, P/T)**
- Increase government investment into vascular dementia research with a focus on the seven research domains identified following the First World Health Organization Ministerial Conference on Global Action Against Dementia **(F)**
- Implement actionable dementia strategies:
 - Continue to move forward with the implementation of the Canadian Dementia Strategy, *A Dementia Strategy for Canada: Together we Aspire* **(F)**
 - Work across federal, provincial and territorial levels of government to consolidate various provincial and territorial dementia strategies into a single, all-encompassing national level dementia strategy **(F, P/T)**
- Ensure adequate investments in dementia research **(F)**
 - Ensure a portion of this funding is invested into research on vascular dementia, a subset of vascular cognitive impairment **(F)**

- Ensure prevalence, incidence, mortality, and other indicators on dementia are reported by type of dementia, to better distinguish vascular dementia from other dementia subtypes **(F, P/T)**
 - Use this data to inform healthcare services and programs for those with vascular dementia **(F, P/T, M)**
 - Recognize the value of provincial or regional centers of excellence for dementia care and work together with provinces to ensure all people in Canada have access to these centers for needed care **(P/T)**
 - Work with health systems planners, healthcare institutions, healthcare providers and people with heart and brain condition to develop more integrated care solutions within the Canadian healthcare system **(P/T)**
 - Continue to engage in conversations with people with lived experience of vascular cognitive impairment about medical assistance in dying (MAID) and the need for advanced requests made prior to significant cognitive decline **(F)**

3. Health system planners:

- Recognize the value of centers of excellence for dementia care:
 - Ensure equitable access to centers of excellence regardless of cost or travel barriers. Use technology to ensure virtual access of certain services
- Adopt practices for screening and early/routine assessment of vascular cognitive impairment for at-risk populations, including people with heart conditions or stroke:
 - Implement relevant recommendations outlined in Heart & Stroke's newly developed vascular cognitive impairment guidelines ****The CSBPR Vascular Cognitive Impairment Guideline is currently under review; an updated version will become available in the winter of 2022**
 - Implement relevant recommendations outlined in the new guidelines developed by the Canadian Consensus Conferences on the Diagnosis and Treatment of Dementia (CCCDTD) in 2020
 - Incorporate screening tools into general assessments. Address gaps in early assessment, routine assessment, and screening for certain high-risk groups for vascular cognitive impairment
 - Invest in technology and electronic medical record systems to improve the capture of this information
 - For people with stroke, screening for cognitive impairment should occur prior to discharge in both acute care and inpatient rehabilitation settings. Screening may also take place in the follow-up stages of recovery (e.g., outpatient and community-based healthcare settings)

****The CSBPR Vascular Cognitive Impairment Guideline is currently under review; an updated version will become available in the winter of 2022**

- Establish better mechanisms to effectively connect or refer individuals to necessary healthcare services:
 - Work within the healthcare system to develop these connections to optimize care, patient experience, and clinical outcomes
 - Ensure care of people with vascular cognitive impairment continues into the community following discharge
 - Ensure better linkages to community programs and services and maintenance of relationships with care providers following discharge
- Work in partnerships with Indigenous communities to seek out solutions to care gaps for Indigenous people with vascular cognitive impairment
- Explore how virtual health can be integrated into existing healthcare services to better serve people living with vascular dementia, and their caregivers

4. Healthcare providers including allied health professionals:

- Promote preventative measures among people who are at risk for developing vascular cognitive impairment
- Ensure at-risk individuals are screened for vascular cognitive impairment as necessary and at different stages of care
- Move towards multidisciplinary models of care:
 - Be informed about the value of working on interdisciplinary teams with regards to improved patient outcomes. Use this as an opportunity for professional development
 - Clinicians, nurses and other allied health professionals should work in partnership to provide patient-centric care through comprehensive team-based care
- Commit to providing continued care for people with vascular cognitive impairment following discharge into the community as care needs continue to develop:
 - Refer people living with vascular cognitive impairment and caregivers to community programs and services
 - Keep the lines of communication open with people living with vascular cognitive impairment and caregivers as care needs evolve
- Become familiar with the Canadian Stroke Best Practice Guidelines on vascular cognitive impairment including comorbidities that could lead to a misinterpretation of screening results such as sensorimotor deficits (e.g., hearing or vision loss)

- Learn how virtual health can be introduced into care practices:
 - Offer people living with vascular cognitive impairment and their caregivers virtual health options that meet their specific needs such as telehealth
- Engage in culturally safe care practices. Work with Indigenous communities and other marginalized populations to understand their specific needs
- Listen to the concerns of people with lived experience and caregivers with regards to medical assistance in dying (MAID). Direct individuals to resources that can assist with end-of-life planning

5. Researchers, research institutions and research funders:

- Fund and/or perform research which addresses the various gaps in our understanding of vascular cognitive impairment including but not limited to:
 - Determine the standard for defining and diagnosing vascular cognitive impairment:
- Develop an understanding of the biomarkers that signal neurodegenerative diseases or changes that lead to vascular cognitive impairment
 - Focus on prevention measures:
- Determine the effectiveness of recognizing and treating early warning signs of heart disease and stroke to support vascular cognitive impairment prevention
- Determine the role of modifiable and non-modifiable risk and protective factors in vascular cognitive impairment and interventions targeted towards treatment of these factors
- Determine the interplay between the social and cultural determinants of health, risk and protective factors, and co-existing vascular diseases
 - Explore the effectiveness of screening interventions to assess early onset of vascular cognitive impairment in at-risk populations
 - Explore optimal models of care and treatment for individuals with vascular cognitive impairment
- Address how pre-existing chronic conditions (especially conditions associated with neurodegenerative disease) can increase the complexity of care required
 - Perform research on effective therapeutic interventions to address vascular cognitive impairment
 - Explore effective rehabilitation interventions for people with vascular cognitive impairment and the adoption of these interventions into practice
 - Explore options for virtual health and determine which types of virtual health interventions are most effective

- Ensure research also explores vascular cognitive impairment in younger people to further elucidate the impact of vascular cognitive impairment on the quality of life of younger people as well as the associated challenges that younger people face
- Ensure research makes considerations for biological sex and gender (socially constructed roles) where relevant:
 - Report the sex of organisms or participants used in research and ensure adequate representation of both sexes
 - Account for sex and gender in the research design, ensure results are disaggregated by sex and gender, and discuss potential implications in the analysis
- Work in partnership with Indigenous communities to identify research needs. Include Indigenous individuals on research teams as researchers and as research participants

6. Academic institutions with faculties of medicine, nursing, and allied healthcare:

- Ensure curricula reflects the current understanding of vascular cognitive impairment:
 - Understand the risk for vascular cognitive impairment for people with heart conditions and/or stroke
 - Discuss strategies for prevention including interventions that target modifiable and non-modifiable risk factors
 - Consider the effects of social and culturally environments on the development of risk factors associated with vascular diseases
- Adopt a multi-disciplinary, team-focused approach throughout curricula:
 - Foster a culture of interdisciplinary collaboration by having medical, nursing, and allied health students work together on projects and workshops throughout their education

7. Industry groups:

- The food industry:
 - Take a leadership role to continue to reduce sodium, sugar and saturated fat during processing and preparation of all foods sold in Canada
 - Provide nutritional information, including sodium, sugar and saturated fat content, of all foods and beverages on overhead menu boards and table menus in food service outlets
 - Stop the practice of marketing of foods and beverages high in sodium, sugar and saturated fats to children
 - Support the federal government's efforts to:

- i. restrict the marketing of foods high in sugar, sodium and saturated fats to children
 - ii. implement the recently adopted front-of-package nutrition labelling on pre-packaged food products to help people in Canada make improved choices that benefit health
- The technology industry:
 - Understand the role assistive technology can play (e-health, mobile health) in assisting individuals with vascular cognitive impairment and their caregivers
 - Form partnerships with health systems planners and healthcare providers to adapt available technology for assessment and monitoring of heart-brain conditions (i.e., blood pressure monitoring application, electronic medical records with built in assessment for cognition following discharge from rehabilitation for stroke)

References

1. Heart & Stroke's Analysis of Data (Based on ICD Codes Defined by Heart and Stroke Foundation) from the Canadian Institute for Health Information's Discharge Abstract Database for 2016-2017. Quality Indicator: Admission Frequency.
2. Gorelick PB, Scuteri A, Black SE, et al. Vascular contributions to cognitive impairment and dementia: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2011;42(9):2672-2713. doi:10.1161/STR.0b013e3182299496
3. Public Health Agency of Canada. Mapping Connections: An Understanding of Neurological Conditions in Canada: The National Population Health Study of Neurological Conditions. Ottawa (ON): Public Health Agency of Canada; [Modified 2014 Dec 09; Cited July 30, 2015]. [Bhttp://www.Phac-Aspc.Gc.ca/Publicat/Cd-Mc/Mc-Ec/Index-Eng.Php](http://www.phac-aspc.gc.ca/publicat/cd-mc/mc-ec/index-eng.php).
4. Public Health Agency of Canada, ed. 2009 Tracking Heart Disease and Stroke in Canada. Public Health Agency of Canada; 2009.
5. Bocti C, Black S, Frank C. Management of dementia with a cerebrovascular component. *Alzheimers Dement*. 2007;3(4):398-403. doi:10.1016/j.jalz.2007.07.009
6. Lee M, Saver JL, Hong KS, et al. Cognitive impairment and risk of future stroke: a systematic review and meta-analysis. *CMAJ*. 2014;186(14):E536-546. doi:10.1503/cmaj.140147
7. Deckers K, Schievink SHJ, Rodriquez MMF, et al. Coronary heart disease and risk for cognitive impairment or dementia: Systematic review and meta-analysis. *Ginsberg SD, ed. PLoS ONE*. 2017;12(9):e0184244. doi:10.1371/journal.pone.0184244
8. Vogels RLC, Oosterman JM, Harten BV, et al. Profile of Cognitive Impairment in Chronic Heart Failure. *J Am Geriatr Soc*. 2007;55(11):1764-1770. doi:10.1111/j.1532-5415.2007.01395.x
9. Alagiakrishnan K, Mah D, Ahmed A, Ezekowitz J. Cognitive decline in heart failure. *Heart Fail Rev*. 2016;21(6):661-673. doi:10.1007/s10741-016-9568-1
10. Cannon JA, Moffitt P, Perez-Moreno AC, et al. Cognitive Impairment and Heart Failure: Systematic Review and Meta-Analysis. *Journal of Cardiac Failure*. 2017;23(6):464-475. doi:10.1016/j.cardfail.2017.04.007
11. Kalantarian S, Stern TA, Mansour M, Ruskin JN. Cognitive impairment associated with atrial fibrillation: a meta-analysis. *Ann Intern Med*. 2013;158(5 Pt 1):338-346. doi:10.7326/0003-4819-158-5-201303050-00007
12. Rivard L, Friberg L, Conen D, et al. Atrial Fibrillation and Dementia: A Report From the AF-SCREEN International Collaboration. *Circulation*. 2022;145(5):392-409. doi:10.1161/CIRCULATIONAHA.121.055018
13. GBD 2016 Causes of Death Collaborators. Global, regional, and national age-sex specific mortality for 264 causes of death, 1980-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390(10100):1151-1210. doi:10.1016/S0140-6736(17)32152-9
14. Statistics Canada. Deaths, by cause, Chapter IX: Diseases of the circulatory system (I00 to I99). Published May 10, 2018. Accessed March 19, 2019. <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310014701>
15. Heart & Stroke's Analysis of Data (Based on ICD Codes Defined by Heart and Stroke Foundation) from the Canadian Institute for Health Information's Discharge Abstract Database for 2016-2017.
16. Beam CR, Kaneshiro C, Jang JY, Reynolds CA, Pedersen NL, Gatz M. Differences between women and men in incidence rates of dementia and Alzheimer's disease. *JAD*. 2018;64(4):1077-1083. doi:10.3233/JAD-180141
17. Statistics Canada. Social determinants of health for the off-reserve First Nations population, 15 years of age and older, 2012. Published April 12, 2016. Accessed April 16, 2020. <https://www150.statcan.gc.ca/n1/pub/89-653-x/89-653-x2016010-eng.htm>
18. Warren LA, Shi Q, Young K, Borenstein A, Martiniuk A. Prevalence and incidence of dementia among indigenous populations: a systematic review. *Int Psychogeriatr*. 2015;27(12):1959-1970. doi:10.1017/S1041610215000861
19. Jacklin K, Walker J, Shawande M. The emergence of dementia as health concern among First Nations populations in Alberta, Canada. *Can J Public Health*. 2013;104(1):e39-e44.
20. Jacklin K, Blind M. Developing culturally grounded dementia educational materials for Indigenous community-based care. Presented at:
21. Livingston G, Huntley J, Sommerlad A, et al. Dementia prevention, intervention, and care: 2020 report of the Lancet Commission. *The Lancet*. 2020;396(10248):413-446. doi:10.1016/S0140-6736(20)30367-6
22. Rockwood K, Middleton L. Physical activity and the maintenance of cognitive function. *Alzheimer's & Dementia*. 2007;3(2S):S38-S44. doi:10.1016/j.jalz.2007.01.003
23. Barnett DW, Barnett A, Nathan A, Van Cauwenberg J, Cerin E, on behalf of the Council on Environment and Physical Activity (CEPA) – Older Adults working group. Built environmental correlates of older adults' total physical activity and walking: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act*. 2017;14(1):103. doi:10.1186/s12966-017-0558-z
24. Martínez-Lapiscina EH, Clavero P, Toledo E, et al. Mediterranean diet improves cognition: the PREDIMED-NAVARRA randomised trial. *J Neurol Neurosurg Psychiatry*. 2013;84(12):1318-1325. doi:10.1136/jnnp-2012-304792
25. Kessels RPC, Eikelboom WS, Schaapsmeeders P, et al. Effect of Formal Education on Vascular Cognitive Impairment after Stroke: A Meta-analysis and Study in Young-Stroke Patients. *J Int Neuropsychol Soc*. 2017;23(3):223-238. doi:10.1017/S1556617716001016
26. Loring B, Organisation mondiale de la santé, Bureau régional de l'Europe. Tobacco and Inequities: Guidance for Addressing Inequities in Tobacco-Related Harm. World Health Organization, Regional office for Europe; 2014.
27. Canadian Institute for Health Information. Trends in Income-Related Health Inequalities in Canada: Technical Report.; 2015:295.
28. Choi D, Choi S, Park SM. Effect of smoking cessation on the risk of dementia: a longitudinal study. *Ann Clin Transl Neurol*. 2018;5(10):1192-1199. doi:10.1002/acn3.633
29. Ohara T, Ninomiya T, Hata J, et al. Midlife and Late Life Smoking and Risk of Dementia in the Community: The Hisayama Study. *J Am Geriatr Soc*. 2015;63(11):2332-2339. doi:10.1111/jgs.13794
30. Zhong G, Wang Y, Zhang Y, Guo JJ, Zhao Y. Smoking Is Associated with an Increased Risk of Dementia: A Meta-Analysis of Prospective Cohort Studies with Investigation of Potential Effect Modifiers. *Laws K, ed. PLoS ONE*. 2015;10(3):e0118333. doi:10.1371/journal.pone.0118333
31. Lara E, Martín-María N, De la Torre-Luque A, et al. Does loneliness contribute to mild cognitive impairment and dementia? A systematic review and meta-analysis of longitudinal studies. *Ageing Research Reviews*. 2019;52:7-16. doi:10.1016/j.arr.2019.03.002
32. Kuiper JS, Zuidersma M, Oude Voshaar RC, et al. Social relationships and risk of dementia: A systematic review and meta-analysis of longitudinal cohort studies. *Ageing Research Reviews*. 2015;22:39-57. doi:10.1016/j.arr.2015.04.006

33. Penninkilampi R, Casey AN, Singh MF, Brodaty H. The Association between Social Engagement, Loneliness, and Risk of Dementia: A Systematic Review and Meta-Analysis. *JAD*. 2018;66(4):1619-1633. doi:10.3233/JAD-180439
34. Michalowsky B, Thyrian JR, Eichler T, et al. Economic Analysis of Formal Care, Informal Care, and Productivity Losses in Primary Care Patients who Screened Positive for Dementia in Germany. Lee TJ, ed. *JAD*. 2015;50(1):47-59. doi:10.3233/JAD-150600
35. Eskes GA, Lanctôt KL, Herrmann N, et al. Canadian Stroke Best Practice Recommendations: Mood, Cognition and Fatigue Following Stroke practice guidelines, update 2015. *Int J Stroke*. 2015;10(7):1130-1140. doi:10.1111/ijis.12557
36. Griffith LE, Gruneir A, Fisher K, et al. Insights on multimorbidity and associated health service use and costs from three population-based studies of older adults in Ontario with diabetes, dementia and stroke. *BMC Health Serv Res*. 2019;19(1):313. doi:10.1186/s12913-019-4149-3
37. Statistics Canada, 2017 Deaths, CANSIM Tables: 13-10-0147-01; 13-10-0143-01; 13-10-0145-01; 13-10-0146-01; 13-10-0154-01; 13-10-0155-01; 13-10-0392-01.
38. Public Health Agency of Canada. Canadian Chronic Disease Surveillance System (CCDSS). Published December 15, 2021. Accessed June 1, 2022. <https://health-infobase.canada.ca/ccdss/data-tool/>
39. Krueger H, Koot J, Hall RE, O'Callaghan C, Bayley M, Corbett D. Prevalence of Individuals Experiencing the Effects of Stroke in Canada: Trends and Projections. *Stroke*. 2015;46(8):2226-2231. doi:10.1161/STROKEAHA.115.009616
40. Statistics Canada, Deaths, by Cause, Chapter IX: Diseases of the Circulatory System, Canada, 2016. CANSIM Table: 13-10-0147-01, Chapter VI: Diseases of the Nervous System, Canada, 2016. CANSIM Table: 13-10-0145-01. Chapter VII: Diseases of the Eye and Adnexa, Canada, 2016. CANSIM Table: 13-10-0146-01. ICD-10-CA Codes: I60-I61, I63-I64, I67.6, G08, G45, and H34.2.; 2016.
41. Gall S, Phan H, Madsen TE, et al. Focused Update of Sex Differences in Patient Reported Outcome Measures After Stroke. *Stroke*. 2018;49(3):531-535. doi:10.1161/STROKEAHA.117.018417
42. Pendlebury ST, Rothwell PM. Prevalence, incidence, and factors associated with pre-stroke and post-stroke dementia: a systematic review and meta-analysis. *Lancet Neurol*. 2009;8(11):1006-1018. doi:10.1016/S1474-4422(09)70236-4
43. Zerna C, Lindsay MP, Fang J, Swartz RH, Smith EE. Outcomes in Hospitalized Ischemic Stroke Patients with Dementia on Admission: A Population-Based Cohort Study. *Can J Neurol Sci*. 2018;45(3):290-294. doi:10.1017/cjn.2018.9
44. Statistics Canada, Deaths, by Cause, Chapter IX: Diseases of the Circulatory System, Canada, 2016. CANSIM Table: 13-10-0147-01.; 2016.
45. Heart & Stroke's Analysis of Data from the Canadian Institute for Health Information's Discharge Abstract Database for 2007-2017 (Excluding Quebec). ICD-10-CA Codes I70-74 and I77-78 (All Types of Vascular Disease). ICD-10-CA Code I50 (Heart Failure). ICD-10-CA Codes I20-I22, I24-I25, R94.30, R94.31 (Coronary Artery Disease). ICD-10-CA Codes I05-I08, I34-I37 (Valvular Disease). I44-I49 (Heart Rhythm Disorders). ICD-10-CA I60-I61, I63-I64, G45, H34 (Stroke).
46. McSweeney JC, Cody M, O'Sullivan P, Elberson K, Moser DK, Garvin BJ. Women's early warning symptoms of acute myocardial infarction. *Circulation*. 2003;108(21):2619-2623. doi:10.1161/01.CIR.0000097116.29625.7C
47. Sundbøll J, Horváth-Puhó E, Adelborg K, et al. Higher Risk of Vascular Dementia in Myocardial Infarction Survivors. *Circulation*. 2018;137(6):567-577. doi:10.1161/CIRCULATIONAHA.117.029127
48. Public Health Agency of Canada, Canadian Chronic Disease Surveillance System, Fiscal Year 2016-2017. 40+ Years of Age.
49. Statistics Canada, Deaths, by Cause, Chapter IX: Diseases of the Circulatory System, Canada, 2019. Table: 13-10-0147-01. ICD-10-CA Code I50.
50. Sun LY, Tu JV, Coutinho T, et al. Sex differences in outcomes of heart failure in an ambulatory, population-based cohort from 2009 to 2013. *CMAJ*. 2018;190(28):E848-E854. doi:10.1503/cmaj.180177
51. Andrade J, Aguilar M, Atzema C, et al. The 2020 Canadian Cardiovascular Society/Canadian Heart Rhythm Society Comprehensive Guidelines for the Management of Atrial Fibrillation. *The Canadian journal of cardiology*. Published online 2020. doi:10.1016/j.cjca.2020.09.001
52. Benjamin EJ, Blaha MJ, Chiuve SE, et al. Heart Disease and Stroke Statistics-2017 Update: A Report From the American Heart Association. *Circulation*. 2017;135(10):e146-e603. doi:10.1161/CIR.0000000000000485
53. Heart & Stroke's Analysis of Data from the Canadian Institute for Health Information's Discharge Abstract Database for 2007-2017. ICD-10-CA Code I48 (Atrial Fibrillation). ICD-10-CA Code I46 (Cardiac Arrest). ICD-10-CA Codes I44-I49 (All Heart Rhythm Disorders). Excluding Quebec.; 2016.
54. Ko D, Rahman F, Martins MAP, et al. Atrial fibrillation in women: treatment. *Nat Rev Cardiol*. 2017;14(2):113-124. doi:10.1038/nrcardio.2016.171
55. Bagge CN, Henderson VW, Laursen HB, Adelborg K, Olsen M, Madsen NL. Risk of Dementia in Adults With Congenital Heart Disease: Population-Based Cohort Study. *Circulation*. 2018;137(18):1912-1920. doi:10.1161/CIRCULATIONAHA.117.029686
56. Pagé MG, Kovacs AH, Irvine J. How do psychosocial challenges associated with living with congenital heart disease translate into treatment interests and preferences? A qualitative approach. *Psychol Health*. 2012;27(11):1260-1270. doi:10.1080/08870446.2012.667099
57. Yeung E, Kay J, Roosevelt GE, Brandon M, Yetman AT. Lapse of care as a predictor for morbidity in adults with congenital heart disease. *Int J Cardiol*. 2008;125(1):62-65. doi:10.1016/j.ijcard.2007.02.023
58. Marelli A. The Future of Adult Congenital Heart Disease Research: Precision Health Services Delivery for the Next Decade. *Canadian Journal of Cardiology*. 2019;35(12):1609-1619. doi:10.1016/j.cjca.2019.09.015
59. Verheugt CL, Uiterwaal CSPM, van der Velde ET, et al. Mortality in adult congenital heart disease. *Eur Heart J*. 2010;31(10):1220-1229. doi:10.1093/eurheartj/ehq032
60. Islam S, Yasui Y, Kaul P, Marelli AJ, Mackie AS. Congenital Heart Disease Hospitalizations in Canada: A 10-Year Experience. *Can J Cardiol*. 2016;32(2):197-203. doi:10.1016/j.cjca.2015.05.022
61. DeGuire J, Clarke J, Rouleau K, Roy J, Bushnik T. Blood pressure and hypertension. *Health Reports*. 2019;30(2):10.
62. Heart & Stroke's Analysis of Data from the Canadian Institute for Health Information's Discharge Abstract Database for 2007-2017. ICD-10-CA Codes I60-I61, I63-I64, I67.6, G08, G45, and H34.
63. Sharp SI, Aarsland D, Day S, Sønnesyn H, Alzheimer's Society Vascular Dementia Systematic Review Group, Ballard C. Hypertension is a potential risk factor for vascular dementia: systematic review. *Int J Geriatr Psychiatry*. 2011;26(7):661-669. doi:10.1002/gps.2572
64. Triantafyllidi H, Arvaniti C, Lekakis J, et al. Cognitive Impairment Is Related to Increased Arterial Stiffness and Microvascular Damage in Patients With Never-Treated Essential Hypertension. *American Journal of Hypertension*. 2009;22(5):525-530. doi:10.1038/ajh.2009.35
65. McGuinness B, Todd S, Passmore P, Bullock R. Blood pressure lowering in patients without prior cerebrovascular disease for prevention of cognitive impairment and dementia. *Cochrane Database Syst Rev*. 2009;2009(4). doi:10.1002/14651858.CD004034.pub3
66. Stone JA, Houlden RL, Lin P, Udell JA, Verma S. Cardiovascular protection in people with diabetes. *Canadian Journal of Diabetes*. 2018;42:S162-S169. doi:10.1016/j.jcjd.2017.10.024
67. Xue M, Xu W, Ou YN, et al. Diabetes mellitus and risks of cognitive impairment and dementia: A systematic review and meta-analysis of 144 prospective studies. *Ageing Research Reviews*. 2019;55:100944. doi:10.1016/j.arr.2019.100944
68. Panza F, Lozupone M, Sardone R, et al. Sensorial frailty: age-related hearing loss and the risk of cognitive impairment and dementia in later life. *Therapeutic Advances in Chronic Disease*. 2019;10:204062231881100. doi:10.1177/2040622318811000
69. Thomson RS, Auduong P, Miller AT, Gurgel RK. Hearing loss as a risk factor for dementia: A systematic review: Hearing Loss and Dementia Systematic Review. *Laryngoscope Investigative Otolaryngology*. 2017;2(2):69-79. doi:10.1002/lio2.65

70. Yuan J, Sun Y, Sang S, Pham JH, Kong WJ. The risk of cognitive impairment associated with hearing function in older adults: a pooled analysis of data from eleven studies. *Sci Rep.* 2018;8(1):2137. doi:10.1038/s41598-018-20496-w
71. Vassilaki M, Aakre JA, Knopman DS, et al. Informant-based hearing difficulties and the risk for mild cognitive impairment and dementia. *Age and Ageing.* 2019;48(6):888-894. doi:10.1093/ageing/afz099
72. Wennberg A, Wu M, Rosenberg P, Spira A. Sleep Disturbance, Cognitive Decline, and Dementia: A Review. *Semin Neurol.* 2017;37(04):395-406. doi:10.1055/s-0037-1604351
73. Leng Y, McEvoy CT, Allen IE, Yaffe K. Association of sleep-disordered breathing with cognitive function and risk of cognitive impairment. *JAMA Neurol.* 2017;74(10):1237-1245. doi:10.1001/jamaneurol.2017.2180
74. Statistics Canada. Sleep apnea in Canada, 2016 and 2017. Published October 24, 2018. Accessed June 4, 2020. <https://www150.statcan.gc.ca/n1/pub/82-625-x/2018001/article/54979-eng.htm>
75. Kerner NA, Roose SP. Obstructive Sleep Apnea is Linked to Depression and Cognitive Impairment: Evidence and Potential Mechanisms. *The American Journal of Geriatric Psychiatry.* 2016;24(6):496-508. doi:10.1016/j.jagp.2016.01.134
76. Emdin CA, Wong CX, Hsiao AJ, et al. Atrial fibrillation as risk factor for cardiovascular disease and death in women compared with men: systematic review and meta-analysis of cohort studies. *BMJ.* Published online January 19, 2016:h7013. doi:10.1136/bmj.h7013
77. Humphries KH, Pu A, Gao M, Carere RG, Pilote L. Angina with "normal" coronary arteries: Sex differences in outcomes. *American Heart Journal.* 2008;155(2):375-381. doi:10.1016/j.ahj.2007.10.019
78. United States General Accounting Office. Drug safety: Most drugs withdrawn in recent years had greater health risks for women. Published online January 19, 2001. <https://www.gao.gov/assets/100/90642.pdf>
79. Melloni C, Berger JS, Wang TY, et al. Representation of women in randomized clinical trials of cardiovascular disease prevention. *Circulation: Cardiovascular Quality and Outcomes.* 2010;3(2):135-142. doi:10.1161/CIRCOUTCOMES.110.868307
80. Pilote L, Humphries KH. Incorporating sex and gender in cardiovascular research: the time has come. *Canadian Journal of Cardiology.* 2014;30(7):699-702. doi:10.1016/j.cjca.2013.09.021
81. MacDonald JP. Alzheimer's Disease and Related Dementias in Indigenous Populations in Canada: Prevalence and Risk Factors.; :32.
82. Anderson KM, Olson S. Leveraging Culture to Address Health Inequalities: Examples from Native Communities. *Institute of Medicine of the National Academies;* 2013:107.
83. First Nations Information Governance Centre. National Report of the First Nations Regional Health Survey Phase 3: Volume One.; 2018:181.
84. Durstine JL, Gordon B, Wang Z, Luo X. Chronic disease and the link to physical activity. *Journal of Sport and Health Science.* 2013;2(1):3-11. doi:10.1016/j.jshs.2012.07.009
85. Colcombe S, Kramer AF. Fitness Effects on the Cognitive Function of Older Adults: A Meta-Analytic Study. *Psychol Sci.* 2003;14(2):125-130. doi:10.1111/1467-9280.t01-i-01430
86. Sofi F, Valecchi D, Bacci D, et al. Physical activity and risk of cognitive decline: a meta-analysis of prospective studies: Physical activity and risk of cognitive decline. *Journal of Internal Medicine.* 2011;269(1):107-117. doi:10.1111/j.1365-2796.2010.02281.x
87. Middleton LE, Mitnitski A, Fallah N, Kirkland SA, Rockwood K. Changes in cognition and mortality in relation to exercise in late life: a population based study. *Scalas E, ed. PLoS ONE.* 2008;3(9):e3124. doi:10.1371/journal.pone.0003124
88. Statistics Canada. Household population meeting/not meeting the Canadian physical activity guidelines. Published April 17, 2019. Accessed April 22, 2020. <https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=1310038801>
89. Canadian Society for Exercise Physiology. Adults 65+ – 24-Hour Movement Guidelines. Accessed December 17, 2021. <https://csepguidelines.ca/guidelines/adults-65/>
90. Kanai M, Izawa KP, Kubo H, et al. Association of Perceived Built Environment Attributes with Objectively Measured Physical Activity in Community-Dwelling Ambulatory Patients with Stroke. *IJERPH.* 2019;16(20):3908. doi:10.3390/ijerph16203908
91. Tarraf D, Sanou D, Giroux I. Immigration and Food Insecurity: The Canadian Experience – A Literature Review. In: Muenstermann I, ed. *People's Movements in the 21st Century - Risks, Challenges and Benefits.* InTech; 2017. doi:10.5772/66824
92. GBD 2017 Risk Factor Collaborators. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet.* 2018;392(10159):1923-1994. doi:10.1016/S0140-6736(18)32225-6
93. Middlesex-London Health Unit. Mediterranean Diet. Published 2019. Accessed May 6, 2020. <https://www.healthunit.com/hcp-mediterranean-diet>
94. Smyth A, Dehghan M, O'Donnell M, et al. Healthy eating and reduced risk of cognitive decline: A cohort from 40 countries. *Neurology.* 2015;84(22):2258-2265. doi:10.1212/WNL.0000000000001638
95. Tangney CC, Kwasny MJ, Li H, Wilson RS, Evans DA, Morris MC. Adherence to a Mediterranean-type dietary pattern and cognitive decline in a community population. *American Journal of Clinical Nutrition.* 2011;93(3):601-607. doi:10.3945/ajcn.110.007369
96. Tarasuk V, Mitchell A. Household Food Insecurity in Canada: 2017, 2018. PROOF; 2020:299-312. Accessed May 2, 2020. <http://content.wkhealth.com/linkback/openurl?sid=WKPTLP:landingpage&an=00008486-200510000-00003>
97. Mirza SS, Portegies MLP, Wolters FJ, et al. Higher education is associated with a lower risk of dementia after a stroke or TIA. the Rotterdam Study. *Neuroepidemiology.* 2016;46(2):120-127. doi:10.1159/000443649
98. National Center for Chronic Disease Prevention and Health Promotion (US) Office on Smoking and Health. *The Health Consequences of Smoking – 50 Years of Progress: A Report of the Surgeon General.* Centers for Disease Control and Prevention (US); 2014. Accessed June 5, 2019. <http://www.ncbi.nlm.nih.gov/books/NBK179276/>
99. Barnes S, Anderson L. Low Earning, Unfilled Prescriptions: Employer-Provided Health Benefit Coverage in Canada. *Wellesley Institute;* 2015:40.
100. Sanmartin C, Hennessy D, Lu Y, Law MR. Trends in Out-of-Pocket Health Care Expenditures in Canada, by Household Income, 1997 to 2009. *Statistics Canada;* 2014. Accessed March 19, 2019. <http://www150.statcan.gc.ca/n1/pub/82-003-x/2014004/article/11924-eng.htm>
101. Law MR, Cheng L, Kolhatkar A, et al. The consequences of patient charges for prescription drugs in Canada: a cross-sectional survey. *CMAJ Open.* 2018;6(1):E63-E70. doi:10.9778/cmajo.20180008
102. Law M, Cheng L, Dhalla I, Heard D, Morgan S. The effect of cost adherence to prescription medications in Canada. *CMAJ.* 2012;184(3):297-302.
103. Lopert R, Docteur E, Morgan S. Body Count: The Human Cost of Financial Barriers to Prescription Medications. *Canadian Federation of Nurses Union;* 2018:12. <https://nursesunions.ca/wp-content/uploads/2018/05/2018.04-Body-Count-Final-web.pdf>
104. Polonsky W, Henry R. Poor medication adherence in type 2 diabetes: recognizing the scope of the problem and its key contributors. *Patient Preference and Adherence.* 2016;Volume 10:1299-1307. doi:10.2147/PPA.S106821
105. Osterberg L, Blaschke T. Adherence to medication. *New England Journal of Medicine.* 2005;353(5):487-497.
106. Ngandu T, Lehtisalo J, Solomon A, et al. A 2 year multidomain intervention of diet, exercise, cognitive training, and vascular risk monitoring versus control to prevent cognitive decline in at-risk elderly people (FINGER): a randomised controlled trial. *Lancet (London, England).* 2015;385(9984):2255-2263. doi:10.1016/s0140-6736(15)60461-5
107. Department of Health, Government of Victoria. Dementia-inclusive communities in Victoria. Accessed June 8, 2020. <https://www2.health.vic.gov.au:443/ageing-and-aged-care/wellbeing-and-participation/age-friendly-victoria/dementia-inclusive-communities>

108. Gilmour H. Social Participation and the Health and Well-Being of Canadian Seniors. Statistics Canada; 2015. Accessed May 7, 2020. <https://www150.statcan.gc.ca/n1/pub/82-003-x/2012004/article/11720-eng.htm>
109. Smith KJ, Gavey S, Riddell NE, Kontari P, Victor C. The association between loneliness, social isolation and inflammation: A systematic review and meta-analysis. *Neuroscience & Biobehavioral Reviews*. 2020;112:519-541. doi:10.1016/j.neubiorev.2020.02.002
110. Valtorta NK, Kanaan M, Gilbody S, Ronzi S, Hanratty B. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. *Heart*. 2016;102(13):1009-1016. doi:10.1136/heartjnl-2015-308790
111. Health Canada. Medical assistance in dying. aem. Published June 16, 2016. Accessed June 3, 2020. <https://www.canada.ca/en/health-canada/services/medical-assistance-dying.html>
112. Government of Canada. What we heard report: A public consultation on Medical Assistance in Dying (MAID). Published March 10, 2020. Accessed June 3, 2020. <https://www.justice.gc.ca/eng/cj-jp/ad-am/wwh-cqnae/toc-tdm.html>
113. Hendlmeier I, Bickel H, Heßler-Kaufmann JB, Schäufole M. Care challenges in older general hospital patients: Impact of cognitive impairment and other patient-related factors. *Z Gerontol Geriat*. 2019;52(S4):212-221. doi:10.1007/s00391-019-01628-x
114. Van Bruggen S, Gussekloo J, Bode C, Touwen DP, Engberts DP, Blom JW. Problems experienced by informal caregivers with older care recipients with and without cognitive impairment. *Home Health Care Services Quarterly*. 2016;35(1):11-24. doi:10.1080/01621424.2016.1145166
115. Passos J, Sequeira C, Fernandes L. The Needs of Older People with Mental Health Problems: A Particular Focus on Dementia Patients and Their Carers. *International Journal of Alzheimer's Disease*. 2012;2012:1-7. doi:10.1155/2012/638267
116. Yu F, Li H, Tai C, Guo T, Pang D. Effect of family education program on cognitive impairment, anxiety, and depression in persons who have had a stroke: A randomized, controlled study. *Nurs Health Sci*. 2019;21(1):44-53. doi:10.1111/nhs.12548
117. Public Health Agency of Canada. A Dementia Strategy for Canada. Published online June 17, 2019. Accessed May 14, 2020. <https://www.canada.ca/en/public-health/services/publications/diseases-conditions/dementia-strategy.html>
118. Department of Finance, Government of Canada. Budget 2019: Chapter 4. Published March 19, 2019. Accessed June 10, 2020. <https://www.budget.gc.ca/2019/docs/plan/chap-04-en.html>
119. Stall NM, Tardif P, Sinha SK. Ensuring Canada's first dementia strategy is not shelved and forgotten. *CMAJ*. 2019;191(31):E851-E852. doi:10.1503/cmaj.190929
120. Canadian Institutes of Health Research, Government of Canada. Welcome to the Canadian Institutes of Health Research - CIHR. Published March 17, 2003. Accessed June 11, 2020. <https://cihr-irsc.gc.ca/e/193.html>
121. Canadian Institutes of Health Research, Government of Canada. Canadian Consortium on Neurodegeneration in Aging (CCNA) - CIHR. Published March 28, 2013. Accessed June 11, 2020. <https://cihr-irsc.gc.ca/e/46475.html>
122. Theme 2: Treatment. CCNA-CCNV. Accessed June 11, 2020. <https://ccna-ccnv.ca/theme-2-treatment/>
123. Public Health Agency of Canada. <https://www.canada.ca/en/public-health.html>
124. Public Health Agency of Canada. The Canadian Chronic Disease Surveillance System – An Overview. aem. Published September 6, 2018. Accessed June 11, 2020. <https://www.canada.ca/en/public-health/services/publications/canadian-chronic-disease-surveillance-system-factsheet.html>
125. Public Health Agency of Canada. Multi-sectoral partnerships to promote healthy living and prevent chronic disease. aem. Published July 24, 2014. Accessed June 11, 2020. <https://www.canada.ca/en/public-health/services/chronic-diseases/multi-sectoral-partnerships-promote-healthy-living-prevent-chronic-disease.html>
126. Your guide to Canada's national dementia strategy | Alzheimer Society of Canada. Accessed June 11, 2020. <https://alzheimer.ca/en/Home/Get-involved/Advocacy/National-dementia-strategy-guide>
127. Provide Input on the Dementia Care Action Plan | EngageNL. Accessed June 11, 2020. <https://www.engagenl.ca/engagement-initiatives/provide-input-dementia-care-action-plan>
128. Alberta, Continuing Care Branch. Alberta Dementia Strategy and Action Plan.; 2017.
129. Government of Alberta. Alberta launches provincial dementia strategy. Accessed June 11, 2020. <https://www.alberta.ca/news.aspx>
130. Alberta Health makes plans, but no new funding, to battle dementia epidemic. *Edmonton Journal*. Accessed June 11, 2020. <https://edmontonjournal.com/news/local-news/alberta-health-unveils-long-awaited-dementia-strategy>
131. Canadian Institutes of Health Research, Government of Canada. Government of Canada invests in dementia research about Indigenous Peoples. *gcnews*. Published February 27, 2017. Accessed June 11, 2020. https://www.canada.ca/en/institutes-health-research/news/2017/02/government_of_canadainvestsindementiaresearchaboutindigenouspeop.html
132. Announcing the Launch of the Canadian Indigenous Cognitive Assessment (CICA). CCNA-CCNV. Accessed June 18, 2020. <https://ccna-ccnv.ca/news/announcing-the-launch-of-the-canadian-indigenous-cognitive-assessment-cica/>
133. Indigenous Cognitive Health. CCNA-CCNV. Accessed June 11, 2020. <https://ccna-ccnv.ca/indigenous-cognitive-health/>
134. Indigenous Services Canada, Government of Canada Social Programs. Assisted Living Program. Published December 21, 2017. Accessed June 11, 2020. <https://www.sac-isc.gc.ca/eng/1100100035250/1533317440443>
135. Indigenous Services Canada, Government of Canada. First Nations and Inuit home and community care. Published February 24, 2020. Accessed June 11, 2020. <https://www.sac-isc.gc.ca/eng/1582550638699/1582550666787#chp1>
136. G8 dementia summit declaration. GOV.UK. Accessed June 11, 2020. <https://www.gov.uk/government/publications/g8-dementia-summit-agreements/g8-dementia-summit-declaration>
137. World Health Organization. First WHO Ministerial Conference on Global Action Against Dementia. WHO. Accessed June 11, 2020. <https://www.who.int/mediacentre/events/meetings/2015/global-action-against-dementia/en/>
138. World Health Organization. Global action plan on the public health response to dementia 2017 - 2025. Published online 2017. <https://apps.who.int/iris/bitstream/handle/10665/259615/9789241513487-eng.pdf;jsessionid=85D623337CA84C0E29F6C8B8CFC68CC?sequence=1>
139. Barbarino P, Lynch C, Bliss A, Babas L, Alzheimer's Disease International. From Plan to Impact II: The Urgent Need for Action. *Alzheimer's Disease International*; 2019. <https://www.alz.co.uk/adi/pdf/from-plan-to-impact-2019.pdf>
140. World Health Organization. Risk Reduction of Cognitive Decline and Dementia: WHO Guidelines.; 2019. Accessed January 17, 2020. <https://www.ncbi.nlm.nih.gov/books/NBK542796/>
141. Alzheimer's Disease International. Dementia Friendly Communities - Key Principles. Published online 2017.
142. H. Chertkow. An Action Plan to Face the Challenge of Dementia: INTERNATIONAL STATEMENT ON DEMENTIA from IAP for Health. Published online 2018. doi:10.14283/JPAD.2018.27
143. Canadian Institute for Health Information. Chronic Disease Management in Primary Health Care: A Demonstration of Emr Data for Quality and Health System Monitoring.; 2014:16.
144. Canadian Institute for Health Information. How Canada Compares: Results from the Commonwealth Fund's 2017 International Health Policy Survey of Seniors.; 2018.
145. Canadian Institute for Health Information. Supporting Informal Caregivers – the Heart of Home Care.; 2010:22.
146. Canadian Nurses Association, Canadian Medical Association, HEAL. Integration: A New Direction for Canadian Health Care.; 2013. Accessed June 19, 2020. https://www.cna-aicc.ca/-/media/cna/files/en/cna_cma_heal_provider_summit_transformation_to_integrated_care_e.pdf?la=en&hash=094811D94F0487A196901715B5FE14516ACA194E

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147. Tang EYH, Price C, Stephan BCM, Robinson L, Exley C. Gaps in care for patients with memory deficits after stroke: views of healthcare providers. *BMC Health Serv Res.* 2017;17(1):634. doi:10.1186/s12913-017-2569-5
 148. Kumar S, Tran JL, Moseson H, et al. The Impact of the Virtual Cognitive Health Program on the Cognition and Mental Health of Older Adults: Pre-Post 12-Month Pilot Study. *JMIR Aging.* 2018;1(2). doi:10.2196/12031
 149. Jackson D, Roberts G, Wu ML, Ford R, Doyle C. A systematic review of the effect of telephone, internet or combined support for carers of people living with Alzheimer's, vascular or mixed dementia in the community. *Archives of Gerontology and Geriatrics.* 2016;66:218-236. doi:10.1016/j.archger.2016.06.013
 150. Shah H, Albanese E, Duggan C, et al. Research priorities to reduce the global burden of dementia by 2025. *The Lancet Neurology.* 2016;15(12):1285-1294. doi:10.1016/S1474-4422(16)30235-6

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