CADTH Special Report

Is Canada Prepared for the Surge of Dementia?
What Was the Question?

- How can health policy decision-makers prepare for the potential future use of new and emerging treatments for Alzheimer disease (AD) and other dementias?

What Did We Do?

- We identified emerging technologies for early diagnosis.
- We assessed the infrastructural capacity to deliver amyloid-targeted therapy in Canada, including the availability of PET-CT imaging equipment for confirming treatment eligibility, access to MRI units for monitoring treatment side effects, and IV infusion clinics for administering the treatment.
- We engaged with clinicians who treat people with dementia, researchers involved with dementia-related health research, and people with dementia and their caregivers.

What Did We Find?

- There are several emerging diagnostic technologies — including blood, imaging, saliva, and ocular tests, and artificial intelligence algorithms — that could diagnose AD in its early stages more easily and quickly.
- The availability of PET-CT and MRI units, radiopharmaceuticals, and cyclotrons is currently not sufficient to accommodate the implementation of amyloid-targeted therapies in Canada.
- People living with dementia described barriers to accessing adequate, appropriate, and equitable care. Clinicians and researchers said that access to timely and reliable diagnosis must be improved.

What Does This Mean?

- Our work highlights recent advances in AD diagnosis and treatment, related health system gaps in terms of accessing diagnostic testing and treatment, and the unmet needs of people living with dementia and their caregivers.
- It is important that health systems prepare for the potential surge in the number of people with dementia who might need additional diagnostic tests, treatments, monitoring, and models of care.
What Is Alzheimer Disease and How Common Is It?

Dementia refers to an umbrella set of symptoms affecting cognition (including memory), mood, and behaviour. It is a chronic condition that worsens progressively over time. There may be prodromal stages of mild cognitive impairment that are early signs or symptoms that may indicate the onset of dementia.

Alzheimer disease (AD) is the most common cause of dementia. According to the Alzheimer Society of Canada, more than 700,000 people are currently living with AD or other forms of dementia in Canada, and more than 75,000 individuals are newly diagnosed annually. As the size of the older population increases, the number of people living with dementia is expected to climb, actualizing the “dementia tsunami” that many have warned of.

Dementia already significantly impacts patients, their families, and their caregivers. It is certain to place an enormous burden on the Canadian health care system in the years ahead. Therefore, CADTH has made dementia a focus of its work so that decision-makers have the information they need to improve the health outcomes of people living with dementia while protecting the sustainability of the health system. This document summarizes the evidence reviews completed to date.

Why Is Alzheimer Disease of Particular Concern to Health Decision-Makers in Canada?

In 2016, the estimated annual cost of dementia care to the Canadian health care system was $10.4 billion, an amount that is expected to double by 2031. The Canadian government passed the National Strategy for Alzheimer Disease and Other Dementias Act in 2017. This Act has driven the development of a national dementia strategy for Canada that outlines common principles and a national objective to guide actions related to dementia care across all levels of government.

How Is Alzheimer Disease Currently Treated?

There is no cure for AD. In Canada, there are no approved disease-modifying therapies for AD. The currently available treatment options are limited to the management of symptoms through medication, mainly cholinesterase inhibitors (ChEIs) and various psychosocial interventions (e.g., organized social activities and music therapy).

What Are the New Developments in the Treatment of Alzheimer Disease?

At the time of this summary, the most notable new development in the treatment of AD is the approval of lecanemab in the US. On July 6, 2023, the US FDA approved this drug for people with mild cognitive impairment or in the mild dementia stage of AD. Lecanemab is an amyloid-targeted therapy that was developed based on the hypothesis that AD is caused by an accumulation of amyloid plaques in the brain. Lecanemab blocks the formation of amyloid plaques in contrast to aducanumab, which removes amyloid...
plaques. Aducanumab was approved by the US FDA in 2021, but it was not approved by Health Canada because of the lack of evidence showing the drug’s clinical effectiveness and safety. Lecanemab was submitted to Health Canada in May 2023, but the decision on its approval in Canada has not yet been made.

An 18-month clinical trial found that lecanemab lowered the amount of amyloid plaques in the brains of people with early AD. The study also found that lecanemab reduced cognitive decline by 27% compared with placebo, as measured using a clinical dementia scale (CDR-SB). Major side effects included brain swelling in 12.6% of study patients and brain bleeding in 17.3% of study patients. The FDA warning on the product packaging states that patients must be monitored for potentially dangerous brain swelling and bleeding.

Shortly after the US FDA approved lecanemab, Medicare in the US announced it would cover 80% of the US$26,500-per-year cost of the medication. Medicare is the US government-funded health plan for people aged 65 and older, the age group most people are in when they are first diagnosed with AD.

Another amyloid-targeting AD treatment on the horizon is donanemab. Like aducanumab, donanemab has been developed to remove amyloid plaques. Phase III trial results reported on July 17, 2023, at the Alzheimer Association International Conference, showed that donanemab significantly slowed cognitive and functional decline in people with early AD.

If amyloid-targeted treatments for AD were to be successfully implemented in Canada, a significant amount of infrastructure needs to be in place. This includes sufficient PET-CT testing capacity to confirm the presence of amyloid plaques, infusion clinics to administer treatment, and MRI services to detect and manage amyloid-related imaging abnormalities (ARIA) indicative of brain swelling and bleeding. Because the risk of ARIA is higher in people with a specific gene mutation, increased capacity for genetic testing may be needed so patients can be screened for the mutation before treatment.

With the recent approval of lecanemab in the US, there is an urgent need to understand the readiness of the Canadian health care system to implement this type of treatment, should Health Canada ultimately approve lecanemab.

What Do We Know About Alzheimer Disease Diagnosis, Management, and Models of Care?

Most of the existing evidence on treatments for dementia is limited and preliminary. CADTH undertook several projects to help health care system decision-makers prepare for the potential future use of emerging novel AD treatments. These projects shed light on how AD is currently being diagnosed and treated; the evidence on emerging technologies; the readiness of the health care system to implement the new and emerging technologies; and the views of people involved in dementia care, living with dementia, and caring for people with dementia.

The following information was collected and reviewed:

- current use of ChEIs for AD in Canada
• availability and capacity of PET-CT and MRI diagnostic services to support the use of emerging treatments for AD
• availability of IV infusion clinics across the country
• perspectives of clinicians and researchers
• input from people with dementia and their caregivers
• models of long-term care for people living with dementia, including dementia villages.

What Is the Current Utilization of Cholinesterase Inhibitors to Treat AD in Canada?
A drug utilization analysis on the use of ChEIs in Canada was conducted by CADTH. ChEIs — which include donepezil, galantamine, and rivastigmine — are the main medications used to treat mild to moderate AD. These drugs increase concentrations of neuronal acetylcholine in the brain, which may improve symptoms such as memory loss and cognition. For severe AD, memantine (an N-methyl-D-aspartate receptor antagonist) is used with or without ChEIs to reduce rates of cognitive decline.

ChEIs provide patients with AD with modest cognitive benefits that have been shown to persist over time, although they do not modify disease progression. ChEIs are also associated with a reduction in antipsychotic and anxiolytic drug use, which may delay admission to in-person care. However, their side effects, which include nausea, vomiting, dizziness, and headache, may lead patients to discontinue treatment.

The utilization analysis found that the use of ChEIs from 2017 to 2020 declined across Canada even though the size of the older population increased. At the time of the analysis, most jurisdictions reimbursed ChEIs only under special authorization, limited use, or exception status criteria. The exception was in Manitoba, where 2 ChEIs were reimbursed as a regular benefit and therefore the number of ChEI users increased in this jurisdiction.

What Technologies for the Early Diagnosis of AD Are New and Emerging?
As previously mentioned, AD is most effectively managed if its symptoms are detected early. However, there is currently no single definitive test available that can diagnose AD at an early stage.

Canadian guidelines recommend that primary health care providers watch for potential symptoms in patients who are older or who have risk factors for cognitive disorders. Patients with potential symptoms should then be assessed using validated cognitive screening tools specifically developed for the early identification of mild cognitive impairment. In Canada, AD is usually diagnosed using standardized criteria to assess people who have already started to develop symptoms of the disease. But it can take several years from the onset of symptoms for AD to be diagnosed. The guidelines recommend against routine screening of people who are asymptomatic.
A CADTH Horizon Scan identified a number of emerging technologies for the early identification of dementia that are in the research and development phase. These include blood, imaging, saliva, and ocular tests as well as artificial intelligence algorithms to analyze these tests all at once. Most tests are based on the prominent hypothesis that AD is caused by an accumulation of amyloid plaques in the brain that activate neurofibrillary tangles (tau tangles) that reduce the capacity of neural circuits to work properly, causing memory dysfunction and cognitive impairment. Detecting the presence of amyloid plaques or tau tangles in individuals at risk of developing AD might identify it before the onset of symptoms.

According to the amyloid hypothesis, these tests could diagnose AD in early stages more safely, easily, and quickly, before irreversible damage occurs.

An early diagnosis could allow some individuals to plan for the progression of the disease and possibly take preventive measures. But, for others, it could result in more years of worry, especially because effective disease-modifying treatments are not yet available. The amyloid hypothesis has not been proven, and the pathology of AD is still not known. In fact, there is still a lot unknown about AD and its related conditions. It is hoped that more research and larger clinical trials will show the benefits of these proposed diagnostic tests.

Is Canada Ready to Offer New Amyloid-Targeted AD Therapies?

**Screening**

New amyloid-targeted therapies belong to a new class of AD drugs that are intended to modify or stop the course of early AD by targeting and removing amyloid plaques from the brain. These therapies are also based on the hypothesis that AD is caused by an accumulation of amyloid plaques.

Before a person is treated with an amyloid-targeted therapy, the presence of amyloid plaques in their brain must first be confirmed. This is done using PET-CT imaging. CADTH assessed the infrastructural readiness, in terms of PET-CT services, of the Canadian health care system to introduce amyloid-targeted therapy for AD. The assessment was based on information from the 2019 to 2020 Canadian Medical Imaging Inventory (CMII), which contains data gathered using a web-based survey conducted from November 2019 to February 2020 and from a limited literature search. The findings of the assessment were published in January 2021.

The most common application and overall priority for PET-CT is oncology, which accounts for 79% of clinical PET-CT exams in Canada. According to the report, Canada does not have sufficient inventory of imaging equipment or availability of radiopharmaceuticals and cyclotrons to sustain current use, let alone screening for amyloid plaques. Wait lists for oncology PET-CT exams are already longer than recommended targets, according to available data on PET-CT wait lists in Canada (these data might not have been available for every jurisdiction; wait lists in some jurisdictions may be within recommended targets).

Furthermore, there are many other anticipated new indications that would require the use of PET-CT. If these are adopted in routine clinical practice, they would likely double existing PET-CT exam volumes.

Even if the number of units were increased, availability of, or access to, radiopharmaceuticals or the cyclotrons needed to produce radiopharmaceuticals would not be sufficient (this is already an issue with
current imaging needs). Canada also does not have enough trained technologists to operate the imaging equipment we already have. Without investments in the entire PET-CT infrastructure, the Canadian health care system is not ready to offer PET-CT imaging for AD.

Another CMII report provides an assessment of Canadian health care system readiness to provide all the infrastructure needed to deliver new amyloid-targeting therapies for AD. As noted in the report, MRI imaging is used to monitor the side effects of amyloid-targeted drugs. Patients undergoing amyloid-targeted treatment should expect to receive a minimum of 4 MRI exams. However, the report found that wait lists in Canada for MRI scans already exceed recommended targets according to available data on wait lists for MRI services in Canada (data might not have been available for every jurisdiction; wait lists in some jurisdictions may be within recommended targets).  

**Treatment**

New treatments will be administered intravenously; therefore, we need to understand the current capacity at IV infusion clinics to offer amyloid-targeted therapies. To get a sense of the available capacity, a formal web search of privately funded IV infusion clinics across Canada was conducted in 2022.

The search found that a total of 423 privately funded IV infusion clinics offer treatment for a variety of conditions (e.g., cancer, Crohn disease, multiple sclerosis, psoriasis, rheumatoid arthritis, and ulcerative colitis). However, we do not know which drugs are offered at each location or for which indication. A better understanding of Canada’s capacity to provide IV therapy in public and private clinics is needed to assess readiness to support implementation of therapies. It will also be important to ensure that public and private clinics have adequate accountability and oversight mechanisms in place.

**What Are the Perspectives and Experiences of Those Involved in Dementia Care, People With Dementia, and Caregivers?**

**Clinicians and Researchers**

An expert panel was convened to gain an understanding of how clinicians and researchers perceive the state of dementia care in Canada. The panel was made up of clinicians and researchers who provide health care to people with dementia or who participate in dementia-related health research.

Panel members suggested the methods for screening and providing care should be standardized. Recognizing the importance of early diagnosis, panel members said that processes for diagnosing dementia in Canada should evolve so people can be diagnosed earlier and therefore have better access to effective treatments. But they acknowledged that the variability in the clinical presentation and symptoms of dementia, and the mild cognitive impairment that represents prodromal dementia, make early diagnosis challenging.

Echoing the findings of the CMII report, the panel noted the lack of access to PET scanners to detect the presence of amyloid plaques or other dementia-related depositions in the brain as well as to other technologies used to assess patients and their disease progression. Panel members considered genetic and
biomarker screening to be a reliable and cost-effective alternative to PET scans for diagnosing dementia that would decrease the demand for PET scanning equipment and resources.

Panel members said that patients are often unable to receive a timely and reliable diagnosis because nonspecialists and some medical professionals lack advanced training in aging and related conditions and there is a shortage of available specialists. As a solution to this issue, the panel suggested increasing opportunities for primary care physicians, nurse practitioners, and other allied health professionals to access advanced training in aging-related conditions. The introduction of more standardized and collaborative care models with embedded research capabilities for dementia was another strategy suggested by panel members.

**People With Dementia and Their Caregivers**

CADTH convened a 5-member panel of individuals with lived experience of dementia to learn from their firsthand experiences with dementia-related care, treatment, supports, and services. The panel consisted of 2 people living with dementia and 3 people with experience providing care to family members with dementia. All 5 individuals served on at least 1 Canadian dementia research, advocacy, or advisory group.

Panel members spoke about the difficulty they experienced navigating the health care system to access care for dementia. They suggested this might be addressed by having dedicated support staff. They also noted that there are barriers to equitable care. One example raised was that people living in rural or remote communities lack access to health care resources and often do not have sufficient internet and cellular connectivity to be able to use virtual care. In addition, rural populations may be disproportionately affected by dementia because older adults tend to live in these communities.

They also described experiencing various barriers to appropriate or satisfactory care. For example, they did not feel that the care they received addressed their individual needs and preferences. They would like to be more involved in their own care decision-making.

Panel members with dementia described feeling a lack of empowerment. They said they would like access to assistive technologies designed to help them become more independent as long as issues of data collection and privacy are addressed. They also would like to be involved in developing these assistive technologies and other dementia-related supports because often they do not meet their needs.

The panel mentioned that those with young-onset dementia, which is estimated to affect at least 28,000 people in Canada, are frequently overlooked. Young-onset dementia is when the presentation and diagnosis of dementia happens before age 65. They suggested that these patients need better access to appropriate, accessible, and affordable dementia supports, services, and programs.

**What About Innovative Models of Homelike or Community-Based Care?**

Homelike models of long-term care have recently garnered interest as an alternative to traditional institutional long-term care homes for delivering care to people with dementia. These innovative facilities
feature a homelike physical environment, focus on person-centred care, and provide residents with the ability
to participate in aspects of daily life and choose how they spend each day. Staff typically are assigned to the
same residents most of the time, and there are high staff-to-resident ratios.

One homelike model of long-term care that has received considerable attention in the media is the dementia
village. These first of these — the De Hogeweyk village — was developed in the Netherlands for people living
with advanced dementia. In dementia villages, residents each share a house with a small group of people
in a village environment that features amenities typical of a small village, such as a supermarket, a public
garden, and a concert hall. A 2019 CADTH review\(^\text{17}\) found no comprehensive assessments of dementia
villages. However, it was noted that some features of these facilities have been shown to improve the quality
of life of residents, including providing a physical environment that accommodates the needs of people with
dementia, encouraging social interaction and participation in daily life activities, and providing easy access
to the outdoors.

A 2022 CADTH review\(^\text{18}\) looked at the evidence on the small house model of long-term care compared
with the more traditional model. No strong trends emerged from the literature. This was likely due to lack
of consistency in the outcomes measured and variability among the different small house models. These
conclusions align with those of a CADTH review of homelike models of long-term care published a year
earlier,\(^\text{19}\) which found that the reported psychosocial outcomes were inconsistent among the identified
studies. There is a lack of published evidence on both the clinical and cost-effectiveness of homelike models
of long-term care, but the literature generally indicates that residents prefer this care model.

A CADTH Horizon Scan of new and emerging technologies that could help people with dementia remain in
their homes and participate in activities within their own communities is currently under way. It is expected
to be published in November 2023.

What Is on the Horizon?
Several new innovative technologies are emerging to detect, diagnose, and manage AD and related
dementias. They include the following:

- Neuromodulation interventions (e.g., deep brain stimulation and transcranial direct current
  stimulation) are under investigation as treatments for AD and may become treatment options in
  the future if they are shown to be effective. On this topic, CADTH has published the Horizon Scan
  Neuromodulation Technologies for the Treatment of Alzheimer Disease.

- Hearing restorative devices (e.g., hearing aids, cochlear implants, and other implantable hearing
  devices) have been proposed as a way to improve cognitive outcomes of people living with dementia
  or to prevent cognitive decline. Evidence on the effectiveness of these devices for dementia is
  still evolving. On this topic, CADTH has published the Horizon Scan Hearing Restorative Devices
  and Dementia.
• Some studies suggest that virtual reality applications may improve cognitive skills in people with dementia. On this topic, CADTH has published the Horizon Scan *An Overview of Clinical Applications of Virtual and Augmented Reality*.

• Electroencephalography-based cognitive assessment tools have been developed to track the brain function of people with dementia to inform clinical decision-making during their treatment. On this topic, CADTH has published the Horizon Scan *Objective Assessment System for Cognitive Function*.

• A point-of-care tool has been developed that uses artificial intelligence to analyze the facial expressions of people who are unable to reliably communicate their pain, such as residents of long-term care facilities who have moderate to severe dementia. On this topic, CADTH has published the Horizon Scan *Facial Analysis Technology for Pain Detection: A Potentially Useful Tool for People Living With Dementia*.

• A finger prick blood test for detecting AD is currently being investigated. The noninvasive test has been developed to detect the presence of AD-related biomarkers in the blood, which would suggest the biomarkers are present in the brain.\textsuperscript{20}

• Researchers are studying mechanisms for preventing the formation of amyloid plaques rather than just reducing their number.\textsuperscript{21}

• According to the Alzheimer Society of Canada, there are more than 200 drugs for dementia in development.\textsuperscript{3} If any are approved by Health Canada, CADTH will evaluate them and provide reimbursement recommendations to the federal, provincial, and territorial (with the exception of Quebec) public drug plans.

**Conclusion**

A microsimulation study published by the Alzheimer Society of Canada delivered a startling prediction: by 2050, more than 1.7 million people in Canada will be living with AD and other forms of dementia and more than 1 million family members, friends, and neighbours will be helping care for them.\textsuperscript{1} The Canadian health care system will face significant challenges in meeting the increasing demand for effective AD treatment and care.

There is currently a lack of treatment options and supports for people with AD. Because of this, almost every innovative dementia intervention receives a lot of attention. But health care decision-makers want to be able to see beyond the hype, to implement the technologies that will have the most impact, and to know that health care systems can adapt to and support their implementation.

CADTH will continue to identify and evaluate new and emerging technologies for AD and assess the impact they might have on the delivery of dementia care in Canada. This work will help health care systems improve the quality of life of people with dementia today, provide the most effective treatments tomorrow, and prevent dementia in the future.
References


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