

Addressing the Silent Epidemic of Ageing with Diabetes in Canada



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National Institute on Ageing



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About the National Institute on Ageing

The National Institute on Ageing (NIA) is a public policy and research centre based at Toronto Metropolitan University (formerly Ryerson University). The NIA is dedicated to enhancing successful ageing across the life course. It is unique in its mandate to consider ageing issues from a broad range of perspectives, including those of financial, psychological, and social well-being.

The NIA is focused on leading cross-disciplinary, evidence-based, and actionable research to provide a blueprint for better public policy and practices needed to address the multiple challenges and opportunities presented by Canada's ageing population.

The NIA is committed to providing national leadership and public education to productively and collaboratively work with all levels of government, private and public sector partners, academic institutions, ageing related organizations, and Canadians.

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Executive Summary

Diabetes is a serious, often life-limiting illness that impacts nearly four million people in Canada (Diabetes Canada, 2022a).

While diabetes rates are on the rise for all age categories, over half of all prevalent cases of diabetes are among Canadians aged 65 years and above (Government of Canada, 2023a).

With more Canadians living longer than ever before, there is a need to better understand and support older adults living with Type 1 and Type 2 diabetes.

Many older adults living with diabetes will face unique concerns and challenges. Ageing with diabetes can require an individualized treatment plan based on the presence and severity of other health conditions and a person's functional or cognitive status (Meneilly et al., 2018; Sinclair et al., 2019; Stasinopoulos et al., 2021). A diagnosis of dementia, frailty or living with a disability can substantially alter the care for older adults living with diabetes as the risk of hospitalization or relocation to a long-term care home increases (Dhaliwal & Weinstock, 2014; Sinclair et al., 2019). Older adults living with diabetes may also be at an increased risk of falls (Sinclair et al., 2015), urinary incontinence (Wagg et al., 2017), cardiovascular disease (Stone et al., 2018) and other complications related to diabetes, such as experiencing instances of hypoglycemia (Meneilly et al., 2018).

Living with diabetes not only requires considerable daily management, but it is commonly the case that individuals will simultaneously require regular access to primary care, specialist care, and long-term care services, and support from an unpaid caregiver. Living with diabetes also requires regular foot and eye care to prevent and manage complications that can arise from diabetes. Thus, it is no surprise that many older adults living with diabetes may find it challenging to navigate existing health and social care systems and lack access to multidisciplinary and person-centred care that is integrated across different health sectors. Compounding these issues is the fact that the social determinants of health mediate one's ability to afford and access a nutritious diet, pay for out-of-pocket medical expenses, such as foot care, or attend medical appointments. Many provinces only cover a portion of diabetes medications and supplies, which can lead to substantial out-of-pocket costs for individuals living with diabetes (Diabetes Canada, 2023b).

There is reason to be concerned that health and social care systems in Canada are not designed to provide individualized, person-centred and integrated care for older adults living with diabetes. It is already a challenge for many older adults to receive timely access to primary, specialty, mental health, and home and community-based long-term care (Statistics Canada, 2020). There are currently few mechanisms to identify

older adults who need an eye exam or foot assessment to prevent complications from diabetes. There are also key gaps in our understanding of interventions to best support older adults living with multiple chronic conditions (Kastner et al., 2018), such as those aiming to improve care coordination (Northwood et al., 2023). The use of health technologies to support older adults living with diabetes is a potential, but under-explored area (Toschi & Munshi, 2020). Unpaid caregivers play a central role in the day-to-day lives of older adults living with diabetes, however, they need to be supported in helping their care partners manage complications from diabetes, such as foot complications (Doss & Popejob, 2022) and severe hypoglycemia (Mojdami et al., 2020).

As a highly stigmatized disease, there have been considerable local and national advocacy efforts to improve diabetes care. As part of this effort, the purpose of this report is to highlight the unique considerations of older adults living with diabetes, and describe the current issues and challenges facing older Canadians living with diabetes. In response, we propose four recommendations to better support older Canadians living with diabetes:

1. The Canadian federal, provincial and territorial governments need to ensure that diabetes health strategies and research on diabetes include a focus on appropriately recognizing and addressing the unique issues and needs of older Canadians living with diabetes and their caregivers and fully engage them in this work.
2. The Canadian federal, provincial and territorial governments need to create national health information systems that address gaps in our understanding of the prevalence and incidence of diabetes and diabetes complications among older Canadians. Secondly, there is a need to improve mechanisms for reporting and screening through provincial/territorial registries.
3. The Canadian federal, provincial and territorial governments need to prioritize improvements to health and social care system navigation, care integration and transitions of care for older adults living with diabetes and their caregivers. Health and social system improvements should consider the role of comprehensive primary care-led support and clinical pathways with appropriate interprofessional and specialist supports, and be centered around the needs and perspectives of older adults and their unpaid caregivers.
4. Current and future efforts to better address diabetes care must be viewed through a social determinants of health lens. Provincial and territorial governments need to ensure that diabetes prevention and ongoing care are appropriately covered and supported through our publicly funded health and care systems.

Introduction

Diabetes is an umbrella term describing a serious, often lifelong health condition where the body can no longer produce or adequately use insulin, a hormone responsible for maintaining blood sugar levels in the body (PHAC, 2017a). Despite increased awareness of diabetes and improved treatments in recent years, rates of this health condition continue to climb throughout the world (Lau, 2016). Canada is no exception, with diabetes rates increasing 3.3% each year (PHAC, 2022a). In 2022, there were an estimated four million Canadians, or 10% of Canada's population, living with the two most common types of diabetes, Type 1 or Type 2 (Diabetes Canada, 2022a). By 2032, Diabetes Canada estimates that 12% of the population, or approximately 5 million Canadians will have diagnosed Type 1 or Type 2 diabetes – an increase of 27% from 2022. Diabetes Canada (2018) further reports that “Canadians 30 years of age now face a 50% chance of developing the disease in their lifetime” (p. 3), and this risk is as high as 80% for First Nations Peoples in Canada.

A staggering number of older adults are living with diabetes, far exceeding the prevalence across other age groups.

In Canada from 2019 to 2020, approximately 1.95 million prevalent diabetes cases (excluding gestational diabetes) were among adults aged 65 years and above, representing more than half of all cases (Government of Canada, 2023a).

Globally, the rising rates of diabetes in older adults have been described as a “silent epidemic” (Lau, 2016, p. 2). However, the unique and significant issues that impact older adults living with diabetes are often given insufficient attention. As Canada experiences a substantial demographic change marked by a rapidly ageing population (Statistics Canada, 2022a, 2022b), it is imperative to dedicate serious consideration to enhancing the support systems for older Canadians living with diabetes and their unpaid caregivers.

Many older adults living with diabetes can manage with similar strategies to those used for younger age groups. However, individualized approaches to diabetes care are needed for older adults who have more complex and often inter-related health and social needs, such those experiencing frailty, those with other chronic health conditions (Sinclair et al., 2015, 2019) or individuals' living in poverty. Disability and frailty, which increase with age, are the top

two predictors of admission to hospitals, admission to long-term care homes and death for individuals living with diabetes (Sinclair et al., 2015). Diabetes also increases the risk of experiencing other health issues, such as foot (Embil et al., 2018) and eye complications (Lovshin et al., 2019), dementia (Meneilly & Tessier, 2016), and cardiovascular disease (Stone et al., 2018).

Having access to health care services and supports is central to the management and care of older adults living with diabetes. However, for individuals living with diabetes, most of the daily management of diabetes, such as monitoring one's blood glucose levels, ensuring a healthy diet and physical activity, occur outside of health care settings (Banasiak et al., 2020). This means that there also remains an urgent need to examine how to support older adults living with diabetes in their daily lives, such as ensuring they have access to self-management education, nutritious food and opportunities for physical activity, addressing gaps in transportation needs, and building awareness of and support to both prevent and manage diabetes complications. Diabetes also remains a stigmatized health issue, which adds additional challenges for individuals living with diabetes and can lead to worse health outcomes (Banasiak et al., 2020; PHAC, 2022a).

Older adults living with diabetes require person and caregiver-centred care that is well-integrated across primary, specialist and home and community-based care and supports (Embil et al., 2018; Griffith et al., 2019). Ensuring health and social care systems can appropriately support

older adults living with diabetes is poised to become more challenging in the future for several reasons. It is already difficult for many older adults to receive access to primary, specialty and home and community-based care in a timely manner (Statistics Canada, 2020). There are critical health care workforce staffing shortages (CIHI, 2022) and the delivery of health and social care remains highly fragmented across the country (PHAC, 2022a). Unpaid caregivers play a critical role in supporting older adults as they age. However, by 2050, the number of older Canadians who will require the support of unpaid caregivers is projected to more than double, yet due to declining birth rates, women's greater participation in the labour force and families living geographically far apart, there will likely be 30% fewer close family members (e.g., spouses, adult children) and friends available to provide unpaid care (MacDonald et al., 2019).

The effects of the COVID-19 pandemic has only further highlighted the immediate need to improve diabetes care for older adults. In the first year of the pandemic, there were delays in receiving diagnosis and treatment for some types of diabetes care and reduced opportunities for accessing physical activity, supports, food and health care services (PHAC, 2022a; Moin et al., 2022). Older adults had disproportionately high rates of morbidity and mortality from COVID-19, while simultaneously being more impacted by the collateral impacts of the pandemic, such as increased isolation, ageism and reduced access to daily supports (Wister & Speechly, 2020; Government of Canada, 2022). A Canadian analysis of adults 20

years of age and older who presented to a hospital emergency department with COVID-19 in the first year of the pandemic found that severe outcomes were linked to being over the age of 67, having a recent emergency department or hospital visit in past six months, being male and having a pre-existing chronic condition (PHAC, 2022b). 20% of individuals who were admitted, transferred to another acute care facility or died from COVID-19 had diabetes. Some types of diabetes care remained prioritized during the pandemic. For instance, a recent study of adult Ontarians with diabetes found that despite interruptions to some types of care, such as hospitalizations for foot conditions and in-person assessments, the number of adults who underwent a lower limb amputation did not increase in the first two waves of the pandemic compared with previous years (de Mestral et al., 2022). However, our understanding of the impact of the pandemic on older adults living with diabetes is incomplete and will be improved as data emerges as the pandemic subsides.

While there are important issues related to diabetes care across Canada, there have been several recent key steps taken to improve diabetes prevention, care and research. Every November, Diabetes Canada hosts Diabetes Awareness Month in an effort to provide knowledge and raise awareness about diabetes. Nov. 14 was declared World Diabetes Day in 2006 by the United Nations, marking the birthday of Sir Frederick Banting, who discovered insulin, in an effort to raise awareness of diabetes as a global public health issue that impacts one in 10

individuals (IDF, 2022). In 2017, Diabetes Canada advocated for the adoption of the 90-90-90 model, a strategy first implemented to raise awareness and reduce the impact of HIV/AIDS (Diabetes Canada, 2023a). This strategy aims to ensure that: “90% of Canadians live in an environment that preserves wellness and prevents the development of diabetes; 90% of Canadians are aware of their diabetes status; and 90% of Canadians living with diabetes are engaged in appropriate interventions to prevent diabetes and its complications (Diabetes Canada, 2018, p.1). Diabetes Canada conducted a broad consultation with numerous stakeholders that concluded that the strategy required a fourth pillar focused on prevention (Diabetes Canada, 2023a). This resulted in the development and release of *Diabetes 360: A Framework for Diabetes in Canada, Recommendations for Governments* in July 2018. Diabetes Canada advocated to the federal and provincial/territorial governments to adopt *Diabetes 360* following its release.

In 2019, the federal government Standing Committee on Health tabled a report titled *A Diabetes Strategy for Canada* alongside hearing from witnesses and diabetes advocacy organizations (PHAC, 2022a, p. 7). The report had 11 recommendations, one of which was the creation of a Canadian “national plan to prevent and manage diabetes” (PHAC, 2022a, p. 7). On June 29, 2021, *Bill C-237, An Act to Establish a National Framework for Diabetes*, received royal assent. The federal government also pledged \$35 million over five years starting in 2021,

with \$25 million specifically for research, surveillance and the creation of a national framework for diabetes (PHAC, 2022a). This legislation required the Minister of Health to table a *Framework for Diabetes in Canada* and that framework, which was based on *Diabetes 360* (Diabetes Canada, 2018), was tabled in the House of Commons on Oct. 5, 2022.

Despite significant advances in advocacy for diabetes and recent federal legislation and advocacy (PHAC, 2022a), many issues specific to older adults living with diabetes often remain under-represented, under-explored and therefore unaddressed.

For instance, a *Framework for Diabetes in Canada* (PHAC, 2022a) does not explicitly mention the unique needs or considerations facing older adults living with diabetes. Contributing to these challenges are gaps in key areas of research and data collection needed to better understand the current and future needs of older adults living with diabetes. The purpose of this report is to both highlight and address these gaps to

ensure that the needs of older Canadians living with diabetes are better understood and addressed moving forward. To do so, the NIA proposes four recommendations to further our understanding, advocacy, and support of older adults living with diabetes and their caregivers.



Background

Types of Diabetes

It is important to be disease-specific when discussing diabetes (Banasiak et al., 2020). While there are many types of diabetes, the two most common types are Type 1 and Type 2 (Figure 1). Prediabetes occurs when blood glucose or sugar levels are higher than normal but not high enough to lead to a diagnosis of Type 2 diabetes.

It has been estimated that approximately 90 to 95% of all diabetes cases are Type 2, 5 to 10% are Type 1, and 1% are other types (PHAC, 2017a, 2022a). The JDRF created the global Type 1 Diabetes Index (Gregory et al., 2022), which provides data on the Canadian prevalence and incidence by age for Type 1 diabetes (Figure 2).

Figure 1. Type 1 and Type 2 Diabetes (Modified from PHAC, 2017a)

Type 1 Diabetes	Type 2 Diabetes
<ul style="list-style-type: none"> • An autoimmune disease where the body is not able to produce insulin on its own because the body attacks the insulin-producing beta cells in the pancreas • Causes are unknown, but family history increases risk • Typically develops in childhood or adolescence, but does occur in adults too* • People living with Type 1 diabetes need to take insulin through regular injections or an insulin pump • Approximately 5-10% of people who live with diabetes 	<ul style="list-style-type: none"> • A metabolic disorder where the body is not able to use the insulin it makes on its own and/or the body does not make enough insulin • Typically develops in adulthood and risk increases with age (Diabetes Canada, 2018) • Managed through diet, exercise, medications and for some people, insulin • Multiple modifiable and unmodifiable risk factors • Approximately 90-95% of people who live with diabetes

*Can present atypically in later life as latent autoimmune diabetes in adults. (Punthakee et al., 2018)

Figure 2. Prevalence and Incidence of Type 1 Diabetes in Canada in 2022

Age	Prevalence	Incidence
0-19	32,211	3,348
20-59	177,426	5,565
60-69	40,933	1,410
70-79	26,068	1,127
80-89	8,166	0
90-99	587	0

The estimates for the T1D Index are informed by 400-plus publications around the globe and a global survey of more than 500 endocrinologists (Gregory et al., 2022).

These data sources have been fitted to mathematical and machine-learning models to generate estimates of Type 1 diabetes prevalence, incidence, mortality and life expectancy for every country around the world (Gregory et al., 2022). In this model, Type 1 diabetes incidence past the age of 90 is assumed to be non-significant (0) (JDRF, 2023a).

Living with diabetes is known to reduce life expectancy between an estimated five and 15 years, and doubles an individual’s risk of all-cause mortality compared with Canadians living without diabetes (PHAC, 2009; Diabetes Canada, 2018, 2022a). While all-cause mortality from diabetes has been on the decline based on data from 1995 to 2016 (Magliano et al., 2022), diabetes remains a leading cause of death for Canadians (Statistics Canada, 2022c).

How Many Canadians are Ageing with Diabetes?

Older Canadians are living with disproportionately high rates of diabetes (PHAC, 2017a; Hosseini et al., 2019; Statistics Canada, 2022c, Government of Canada; 2023a). In 2019-20, there were approximately 3.58 million Canadians living with diabetes and just over half of these cases are in individuals over the age of 65 (Government of Canada, 2023a). In the future, more older Canadians will be living with diabetes (JDRF, 2023a; Government of Canada, 2023a). For instance, in 2023, there were 79,935 Canadians 60 years of age and above with Type 1 diabetes (T1D Index, 2023). Type 1

diabetes cases will nearly double by 2040 to 144,442 individuals.

There are varying reports of the exact number of individuals who are living with Type 1 and Type 2 diabetes (see Figure 3 below). As seen in Figure 3, diabetes prevalence rates vary based on the case definition of diabetes (namely, the inclusion or exclusion of gestational diabetes and age cut-offs) and whether data is collected from medical records (Canadian Chronic Disease Surveillance System) or as reported by respondents (Canadian Community Health Survey, Canadian Health Survey on Seniors). None of the sources provide a breakdown by diabetes type.

Figure 3. Reported Prevalence of Diabetes by Data Source

Source	Year	Case Definition	Prevalence of diabetes (all Canadians)	Prevalence of diabetes among adults 65+
Canadian Chronic Disease Surveillance System (Government of Canada, 2023a)	2019-20	Type 1, Type 2 diabetes (excludes gestational diabetes), over the age of 1 as indicated by 1+ hospital records or 2+ physician claims within the 2 years	3.583 million	1.951 million
Canadian Community Health Survey (Statistics Canada, 2022d)	2021	Population over 12 who reported Type 1 or Type 2 as diagnosed by a health professional; females over 15 diagnosed with gestational diabetes	2.3727 million	1.1881 million (50% of all cases)
Canadian Health Survey on Seniors (Statistics Canada, 2022e)	2019-20	Population who reported they were diagnosed with Type 1 or Type 2 diabetes by a health professional	n/a	1.217 million

Contributing Factors for Diabetes

Type 1 Diabetes

The contributing factors that can cause Type 1 diabetes are not fully understood (PHAC, 2022a), although having a family member with Type 1 diabetes may be an unmodifiable contributing factor (Heart & Stroke Foundation, 2023).

While it is frequently the case that adult-onset diabetes presents as Type 2 diabetes, Type 1 diabetes cases can be also diagnosed in later life. Differentiating between Type 1 and Type 2 diabetes can be difficult in a subset of individuals who present with an atypical Type 1 diabetes presentation, such as latent autoimmune diabetes in adults (LADA) (Butler & Misselbrook, 2020) or a presentation that initially resembles Type 2 diabetes (Ramtoola et al., 2020). Determining which type of diabetes an individual has is important due to the need for early insulin therapy in Type 1 diabetes (Butler & Misselbrook, 2020).

Late onset of Type 1 diabetes is still a serious health condition, with the potential for the development of comorbid health conditions. In a retrospective British study of 2,430 individuals diagnosed with Type 1 diabetes in adulthood (average age at onset of treatment with insulin was 40.8 +/- 16.1 years), researchers found that despite improved glycemic levels after one year of starting insulin treatment, within five years there were large increases in the amount of comorbid

conditions that participants were diagnosed with (Ramtoola et al., 2020). While the exact cause of these comorbid conditions is unknown, from year 1 to year 5, there was a 411% increase in cases of diabetes-related complications, 356% increase in cases of renal disease, 176% increase in peripheral vascular disease, 172% increase in cerebrovascular disease and a 144% increase in cancer.

Type 2 Diabetes

Factors that can contribute to developing Type 2 diabetes include, “age, physical activity levels, eating habits, obesity, ethnicity, [and having a] family history of diabetes” (PHAC, 2022a, p. 12). Research has also found that Indigenous, African, East Asian and South Asian individuals are at a higher risk of developing Type 2 diabetes than the general population, with Type 2 diabetes prevalence varying amongst these communities as a result of social, environmental and biological contributing factors (PHAC, 2022a).

The social determinants of health play a crucial role in influencing the conditions that can lead to Type 2 diabetes (PHAC, 2022a). The social determinants of health refer to systemic factors that contribute to the development of health inequalities. Those that have been found to contribute to both developing and managing diabetes include “income, education level, employment and working conditions, food security, early childhood development, social support and connectedness, the built environment,” inter-generational trauma, and access to the internet, technology and health care services (PHAC, 2022a, p. 10).

These structural inequalities can impact the ability of individuals to engage in behaviours that prevent or help manage chronic diseases such as diabetes. For instance, being able to access and afford nutritious food, engage in physical activity, or access healthcare is mediated by factors such as income, racism, colonialism, and accessibility (PHAC, 2022a). Living with chronic conditions can also lead to increased out-of-pocket costs, further exacerbating the challenges faced by lower income individuals living with diabetes (Northwood et al., 2018).

Structural inequalities impact some communities more than others. Indigenous people in Canada are disproportionately impacted by diabetes (CCO & PHO, 2019; PHAC, 2022a), and in particular Type 2 diabetes (although available health data does not always differentiate by diabetes type) (Halseth, 2019). Jacklin et al. (2017) wrote: “In Canada and other countries that share a colonial history, health inequities arising from the effects of colonization include deeply rooted disparities in the social determinants of health, social exclusion, political marginalization and historical trauma” (p. 107). While diabetes prevalence varies among First Nations communities (Halseth, 2019), the Public Health Agency of Canada (PHAC) has estimated that, “in comparison to non-Indigenous adults, the prevalence of Type 1 and Type 2 diabetes combined is nearly three times greater for First Nations adults living on reserve and in northern communities, and two times greater for First Nations adults living off reserve” (PHAC, 2018 in Halseth, 2019, p. 7). Further to this, Indigenous Peoples living with diabetes “are diagnosed at an increasingly younger age, have greater

severity at diagnosis, develop higher rates of complications, and experience poorer treatment outcomes” (Crowshoe et al., 2018, p. 297; Halseth, 2019). There remain important gaps in national data collection and research, such as meta-analyses specific to First Nations Peoples, that would improve diabetes prevention, management and care (Halseth, 2019).

Health Considerations for Older Adults Living with Diabetes

While advancing age and length of illness is a predictor of morbidity and mortality from diabetes (Sinclair et al., 2015), older adults living with diabetes are a heterogeneous group and have varying levels of physical and cognitive health and functional capabilities (Sinclair et al., 2019). There are different treatment and management approaches for older adults living with Type 1 and Type 2 diabetes to be considered based on the presence and severity of other chronic conditions, such as kidney and cognitive function, age and overall degree of frailty (Meneilly et al., 2018; Sinclair et al., 2019; Stasinopoulos et al., 2021). Thus, many older adults living with diabetes need an individualized approach to their care (Meneilly et al., 2018; Stasinopoulos et al., 2021). It is important to note that less is known about the management of Type 1 diabetes in older adults compared with Type 2 diabetes (Meneilly et al., 2018).

Many older adults with diabetes live with several other chronic health conditions (Meneilly et al., 2018; Griffith et al., 2019). Diabetes can contribute to

the development of microvascular or macrovascular complications earlier in life compared with individuals without diabetes (Sinclair et al., 2015). Diabetes can contribute to the development of cancers, strokes, heart disease (e.g., heart attacks), kidney disease, foot problems (neuropathy and vascular disease) and eye problems (diabetic retinopathy), which can cause vision changes or blindness (Sinclair et al., 2015; Diabetes Canada, 2022b). Given that many older adults have additional health conditions, it is crucial to view older adults living with diabetes through the lens of multimorbidity and consider the impact of other health conditions on the health and well-being of older individuals (Griffith et al., 2019).

A recent Ontario study aimed to identify how many community-dwelling older adults living with diagnosed diabetes in 2008 had multimorbidity (Griffith et al., 2019). In 2008, there were 376,367 community-dwelling adults over 66 years of age living with diagnosed diabetes in Ontario (representing 22% of all community-dwelling older adults). The study found that of this group, 76% of older adults living with diabetes had more than 2 other health conditions. In addition, 19.2% of older adults had one comorbid condition, 30.3% had two, 23.3% had three, 13.2% had four, and 9.6% had more than five comorbid conditions. The most common comorbid condition was high blood pressure (83%), followed by arthritis (61%), ischemic heart disease (25%), and chronic obstructive pulmonary disease (23%) (Griffith et al., 2019).

Figure 4. Comorbidity vs. Multimorbidity

Comorbidity refers to a situation when “multiple diseases/conditions co-exist with an index disease under study” (Almirall & Fortin, 2013, p. 8).

Multimorbidity means “the co-existence of two or more chronic conditions, where one is not necessarily more central than the others” (Harrison et al., 2021, p. 1). While there is context-specific use for the terms comorbidity and multimorbidity, this report will use the term multimorbidity where possible, as it conceptualizes health more holistically and is more person-centred (Harrison et al., 2021).

In the following pages, particular areas of consideration for older adults living with diabetes are discussed.

Cardiovascular Disease



- Cardiovascular disease is the leading cause of death for individuals living with diabetes (IDF, 2023). Diabetes increases the risk of cardiovascular disease (high blood pressure, atherosclerosis, coronary artery disease, peripheral artery disease, congestive heart failure), strokes and amputations, and people living with diabetes are more likely to develop these conditions prematurely (Stone et al., 2018). Individuals living with diabetes may also have other risk factors that contribute to the development of cardiovascular disease, such as being overweight or smoking (Diabetes Canada, 2022c). Of all Canadian adults with diabetes in 2009, 63% had high blood pressure, which is three times the national average (PHAC, 2009). Canadian adults with diabetes were also “hospitalized three times more often with ischemic heart disease, almost four times more often with heart failure, and almost three times more often with stroke” (PHAC, 2009, p. 3).
- Cardiovascular disease risk can be reduced by managing one’s diabetes and cardiovascular health, which includes pharmacological interventions (i.e., medications to lower blood pressure or cholesterol), regular screening for complications and lifestyle interventions (such as stopping smoking, healthy eating, physical activity and lowering stress) (PHAC, 2009; Stone et al., 2018).

Frailty



- Older adults living with diabetes have an increased likelihood of living with frailty, and frailty also increases the risk of living with diabetes (Sinclair et al., 2015; Meneilly et al., 2018; MacKenzie et al., 2020). While there are varying perspectives on how to best define and measure frailty, the NIA defines frailty as “a state of vulnerability that becomes more prevalent with age and affects an individual’s resilience and ability to deal with minor and major stressors, which can include illnesses or infections” (NIA, 2018, p. 5).
- Frailty has a significant health impact on older adults living with diabetes. As Sinclair et al. (2019) writes: “when frailty occurs, it is a better predictor of complications and death in older people with diabetes than chronological age or a person’s burden of comorbidity” (p. 285). Among older adults living with diabetes, those who were also living with frailty were 2.62 times more likely to experience a complication due to diabetes, when compared with those who were not living with frailty (Hubbard et al., 2010). Frailty is also associated with an increased risk of mortality and length of hospital stay (MacKenzie et al., 2020). Older adults living with diabetes who are experiencing frailty particularly benefit from an individualized approach to their care (Sinclair et al., 2019).

Polypharmacy



- Polypharmacy occurs when an individual takes multiple medications. This is common among older adults living with diabetes often due to the presence of other chronic conditions or complications (Meneilly et al., 2018; Remelli et al., 2022). In a recent scoping review of polypharmacy and older adults, Remelli et al. (2022) found that polypharmacy increases the risk of negative outcomes for older adults living with diabetes, including an increased risk of drug-to-drug interactions, hypoglycemia, poor blood sugar control, having a syncopal episode, experiencing falls, and hospitalizations. Managing polypharmacy for an older adult requires considering the personal and social context of the individual living with diabetes and modifying their treatment regime, and using glycemic targets specific to their associated level of frailty and comorbidities. Management of polypharmacy also involves clinicians actively reconciling a patient's medications and deprescribing medications that may be harmful or unnecessary.

Hypoglycemia



- One challenge unique to older adults living with diabetes is that they have an increased risk of hypoglycemia (blood sugar less than 4.0 mmol/L) (Meneilly et al., 2018). Older adults may not be able to identify that they are experiencing hypoglycemia, and they may be more likely to experience complications of hypoglycemia (Bremer et al., 2009). It may be difficult to identify hypoglycemia because the symptoms are not necessarily specific and can be misdiagnosed as other conditions or situations (e.g. vertigo), or it can present atypically or with little warning or unawareness of symptoms.
- The risk of hypoglycemia increases with age due to age-related changes such as "impaired awareness of hypoglycemia warning symptoms and altered psychomotor performance" (Meneilly et al. 2018, p. 285). Older adults who take insulin or sulfonylureas are also at an increased risk of hypoglycemia. Hypoglycemic episodes also increase the risk of falls, injuries, dementia, seizures, comas or stroke in older adults (Meneilly et al., 2018; Dhaliwal & Weinstock, 2014). Frail older adults living in long-term care settings are at a high risk of hypoglycemia due to ageing, living with multiple chronic conditions, polypharmacy, increased rates of hypoglycemia secondary to cognitive impairment, and impaired kidney function (Dhaliwal & Weinstock, 2014; Meneilly et al., 2018). Older adults who have inconsistent or lower food intake may also need adjustments to their insulin regimen to prevent hypoglycemia (Dhaliwal & Weinstock, 2014).

Glycemic Targets



- A1C is a commonly used measure of glycemic control among individuals living with diabetes (Shah et al., 2021, p. 314). Older adults who are “functionally independent” can be treated similarly to younger adults with respect to glycemic targets, particularly with medications with a low risk of hypoglycemia (Meneilly et al., 2018, p. 284). In these cases, not meeting glycemic targets can increase the risk of infections and hospitalizations (Stasinopoulous et al., 2021) and long-term complications from diabetes, such as microvascular and macrovascular diseases (Mannucci et al., 2014). However, more stringent glycemic control can also have negative effects, primarily the increased risk of hypoglycemia in older adults (Dhaliwal & Weinstock, 2014; Sinclair et al., 2019; Stasinopoulos et al., 2021), particularly for those who are prescribed insulin or sulfonylureas and have complex health problems (Lipska et al., 2015).
- It has been increasingly identified that many older adults with diabetes and more complex health needs require an individualized management approach (Dhaliwal & Weinstock, 2014), particularly when signs of frailty, long-standing diabetes and additional chronic health conditions are also present (Sinclair et al., 2019; Meneilly et al., 2018). The Diabetes Canada Clinical Practice Guidelines for older adults recommend that higher glycemic targets may be appropriate for older adults who are functionally dependent, are frail or have dementia and are taking medications that increase the risk of hypoglycemia (Meneilly et al., 2018). Glycemic targets are not recommended for older adults who are receiving end-of-life care when diabetes management requires an individualized approach (Meneilly et al., 2018). Glycemic measurements can also be unreliable in the context of certain medical conditions, such as anemia, kidney disease, or those receiving blood transfusions (Leung et al., 2018). There are other times when glycemic targets need to be adjusted, such as during periods of sudden illness. Some older adults living with Type 1 diabetes may need more regular adjustments to insulin dosing during a sudden illness to reduce the risk of hypoglycemia, dehydration or other complications (Dhaliwal & Weinstock, 2014).

Figure 5. Canadian Glycemic Targets for Older Adults in Canada

The Canadian guidelines for older adults who are at a low risk of experiencing hypoglycemia (are not taking insulin or sulfonylureas) are as follows:

- Functionally independent older adults: A1C target of $\leq 7\%$
- Functionally dependent older adults: A1C target of $\leq 8\%$
- Older adults experiencing frailty or dementia: A1C target of $\leq 8.5\%$
- It is not recommended to measure A1C for those receiving end-of-life care

For older adults who are taking insulin or sulfonylureas (higher risk of hypoglycemia):

- Functionally dependent older adults should have an A1C target between 7.1-8%
- Older adults experiencing dementia/frailty should have an A1C target between 7.1-8.5%

Adapted from Meneilly et al., 2018

Diabetes Canada Clinical Practice Guidelines Expert Committee

How Many Older Adults are Being Treated to Appropriate Glycemic Targets?:

- Many studies have aimed to determine whether older adults living with diabetes are being treated to the appropriate glycemic targets, or if older adults experience under or overtreatment of their diabetes. A combination of thresholds is often used to define under and overtreatment, including A1C levels usage of glucose-lowering medications and the presence of other health conditions (Stasinopoulos et al., 2021).
- **Overtreatment of Diabetes:** Several Canadian studies have found various ranges of older adults being potentially overtreated for their diabetes (Lega et al., 2021; Shah et al., 2021; Gudi et al., 2022). For instance, a recent Ontario study found that approximately 61 per cent of community-dwelling adults 75 years of age and above diagnosed with diabetes were being treated to

intensive glycemic control (A1C of $\leq 7\%$ or under), with almost one-fifth of these individuals being treated with high-risk agents (e.g., insulin or sulfonylureas) (Lega et al., 2021). The study found that there was a “nearly 50% increased short-term risk of diabetes-related hospital visits or death associated with intensive glycemic control with insulin or sulfonylureas” compared with less intensive glycemic control (p. 1100). Another study of more than 1.2 million Ontario residents living with diabetes found older adults had tighter glycemic control than younger people, with the share of those with an A1C over 8% decreasing with age (Shah et al., 2021). Older adults aged 80 to 89 had a median A1C of 6.7% (compared with 8.2% among teenagers), which could be the result of survivor bias, or suggests overtreatment. Another study using data from 2010 to 2017 found that among a sample of 41,032 older adults with Type 2 diabetes across eight Canadian provinces, 7% of older adults

were potentially overtreated, with a higher prevalence of overtreatment among older adults aged 80 years and older living with dementia (Gudi et al., 2022). The study found only 3% of older adults reportedly being undertreated in 2012, and 2.7% in 2016.

- While the precise cause of overtreatment is unknown, Lega et al. (2021) suggest that it could be due to clinical inertia, referring to the continuation of treatment without considering the need for individualized treatment plans, or gaps in best practices related to deescalating treatment for older adults. There may also be a need to ensure that the most up to date clinical guidelines (Meneilly et al., 2018) are being distributed and implemented by healthcare providers (Lega et al., 2021).
- **Undertreatment of Diabetes:** Globally, a recent meta-analysis found that approximately a third of individuals (from all age categories) with Type 2 diabetes and one-quarter of individuals with Type 1 diabetes met recommended glycemic targets (Mannucci et al., 2014). In the Canadian context, a 2013 national study of 5,123 individuals with an average age of 64 living with Type 2 diabetes found that only 50% of individuals were meeting an A1C target of $\leq 7\%$, and 78.1% had a target of $\leq 8\%$, (Leiter et al., 2013). Only 13% were meeting their recommended levels for A1C, blood pressure and cholesterol (Leiter et al., 2013). In another Canadian study of 48,143 adults aged 40 and above, 14.51% had an A1C level over 8.5, which is suggestive of uncontrolled glycemic levels (Coons et al., 2017).

Adults aged 60 to 69 had a higher rate of uncontrolled glycemic levels, at 14.63%, compared to 9.04% of adults aged 70 to 79 and 8.42% of adults over 80 years of age.

- **Treatment Considerations for Older Adults Living in Long-Term Care (LTC) Homes:** Older adults residing in LTC homes often have more complex health needs that require individualized glycemic targets (Stasinopoulos et al., 2021). However, there are currently gaps in best practices and a lack of national standards for managing diabetes amongst those living in LTC homes in Canada, such as guidelines that could support treatment intensity decisions. This is particularly concerning due to the increased risk of hypoglycemia amongst older adults living with diabetes in LTC (Dhaliwal & Weinstock, 2014; Meneilly et al., 2018).
- It remains unknown whether older adults across Canada residing in LTC are being treated appropriately. In a recent systematic review of over and undertreatment of older adults living with Type 2 diabetes in LTC homes, estimates of over and undertreatment varied considerably due to the different definitions being used, although overall, there were 15 studies that reported overtreatment (15 studies) and 8 studies reporting undertreatment (Stasinopoulos et al., 2021). Rates of overtreatment ranged from 5% to 86% and rates of undertreatment ranged from 1.4% to 5%. The prevalence of dementia, lower insulin use and individuals experiencing greater impairment in activities of daily living (ADL) led to higher rates of

overtreatment. There were fewer studies examining undertreatment of diabetes and none of these studies reported on the factors that may be associated with the undertreatment of diabetes.

- In a study of 214 older adults residing across six not-for-profit LTC homes in British Columbia, 54% of residents being treated for diabetes were being potentially overtreated based on having A1C levels less than or equal to 7.5% and taking one hypoglycemic medication (McCracken et al., 2017). The study also found that participants living with diabetes who were overtreated were taking 3.8 more medications (excluding hypoglycemic medications) than participants who were not being overtreated.

Falls



- Older adults living with diabetes may face an increased risk of falls (Sinclair et al., 2015; Yang et al., 2016; Sarodnik et al., 2018; Shah et al., 2018). There are a multitude of factors that are thought to increase this risk, such as the presence of other comorbidities, polypharmacy, sarcopenia (muscle loss) and diabetes-related complications such as diabetic neuropathy (numbness in the feet, hand, legs or motor neuropathies and retinopathy (visual problems) (Berlie & Garwood, 2010; Sarodnik et al., 2018), and severe hypoglycemia among adults with Type 1 diabetes (Shah et al., 2018). Older adults who take insulin have an additional increased risk of falls, although it is unknown if insulin causes falls directly (i.e., causes hypoglycemia leading to falls) or indirectly is a

marker of other complications or illness severity that can contribute to an increased risk of falls (Berlie & Garwood, 2010; Yang et al., 2016). Older adults with Type 2 diabetes have also been found to have an increased fear of falling, which can pose barriers to physical exercise and lead to social isolation and a greater loss of functional independence (Hewston & Deshpande, 2018).

Osteoporosis



- Type 1 diabetes has also been found to be associated with osteoporosis and research has found an increased risk of a hip fracture in women with Type 1 diabetes compared to women without diabetes (Forsen et al., 1999 and Nicodemus et al., 2001 in Meneilly et al., 2018).

Sexual Health



- Individuals living with diabetes also experience higher rates of sexual dysfunction (Edwards, 2016; Winkley et al., 2021). For instance, males with diabetes experience erectile dysfunction at a higher rate and earlier than males without diabetes (Kamenov, 2014; Defeudis et al., 2022). Many complex factors are associated with erectile dysfunction, such as cardiovascular disease, diabetic neuropathy and high blood pressure (Defeudis et al, 2022). While there has been more attention to men's sexual health compared to women, there has been increasingly more attention has

been directed towards women's sexual health (Meeking et al., 2013; Edwards, 2016). Diabetes can impact many aspects of sexual health among women, making the treatment for women more complex (Meeking et al., 2013). Women may experience decreased desire or satisfaction, pain during sexual activity, and an increased risk of infections (Edwards, 2016). Mental health conditions, such as depression, can also contribute to sexual health problems, and vice versa (Winkley et al., 2021). As an overlooked issue, particularly among women living with diabetes, sexual health should be addressed by health providers for both men and women.

Urinary Problems and Incontinence



- Incontinence is remarkably common. In Canada, it has recently been estimated that around 24 per cent of the adult population is living with urinary incontinence (UI) (Shaw et al., 2020). Prevalence for UI increases with age (Milson, 2017). Diabetes may cause or contribute to UI in frail older adults because if it is poorly controlled, it can lead to excess urination, which can then cause or make incontinence worse (Wagg et al., 2017). Nerve damage in the bladder is also common among individuals with diabetes, which, combined with other factors such as high glucose levels in the urine, increase the likelihood of bladder and urinary tract infections (Diabetes Quebec, 2014). UI among older adults living with diabetes is associated with reductions in quality of life (Coyne et al., 2014).

- A recent Ontario study found that from 2011 to 2016, 33% of older adults with Type 2 diabetes using home care services experienced daily episodes of urinary incontinence (Northwood et al., 2021a). Multiple, complex factors were impacting older adults living at home with diabetes and UI. UI was correlated with multimorbidity, caregiver distress, economic trade-offs (limited funds that resulted in an individual being unable to afford food or medications, heat their home or seek physician care), sex (female), falls, and cognitive and functional impairments. In another key finding, older adults with diabetes and UI were at an increased risk of LTC home admission when compared with individuals not experiencing incontinence.

Dementia



- Those living with diabetes are at a greater risk for developing problems with memory and cognition, including both vascular dementia and Alzheimer's disease (Meneilly & Tessier, 2016; Meneilly et al., 2018; Jacobson et al., 2021). The risk of dementia in individuals with diabetes is increased by a factor of 2 "in relation to age, ethnicity, education, the presence of depression, microvascular and macrovascular disease, lower-extremity complications and longer duration of diabetes" (Meneilly & Tessier, 2016, p. 74). Repeated or severe episodes of hypoglycemia may also increase the risk of developing dementia among older adults. In a longitudinal study of 1,051 adults with Type 1 diabetes over 32 years, Jacobson et al. (2021) found

that having more instances of severe hypoglycemia, high blood pressure, and higher A1C levels was associated with cognitive decline by the average age of 59. The researchers report that “these three risk factors were associated with cognitive decline equivalent to an additional 9.4 years of age, thereby suggesting premature aging” (p. 12).

- Dementia may also be a risk factor for severe hypoglycemia (Meneilly & Tessier, 2016) and make the overall management of diabetes more challenging for individuals living with both dementia and diabetes (Dhaliwal & Weinstock, 2014). Dementia causes cognitive dysfunction, which can impact the ability of those living with diabetes to manage the condition, as monitoring one’s glucose levels and managing medications can become difficult (Biessels & Whitmer, 2020). Dementia reduces one’s ability to recognize and/or communicate the symptoms of hypoglycemia to caregivers (Hopkins et al., 2016). Living with dementia and diabetes makes managing self-care tasks more challenging, can lead to reduced physical function and can increase the risk of hospitalization (Sinclair et al., 2000). Caregivers may also find that their role becomes more intense as they take on new responsibilities, like daily medication management or insulin injections (Hopkins et al., 2016). Caregivers for older adults living with dementia provide an average of 26 hours of care per week, compared with only 17 hours for those caring for older people that are not living with dementia, and also experience higher rates of caregiver distress (CIHI, 2018).

Mental Health



- The risk of mental health disorders, including depression, is increased in people with diabetes, including older adults (Meneilly et al., 2018; Robinson et al., 2018). Risk factors associated with developing depression in individuals with diabetes include having fewer social supports, having a longer duration of diabetes, and the presence of long-term complications (Robinson et al., 2018). Despite the increased risk of depression in older adults living with diabetes, screening is not routinely done (Sinclair et al., 2015).
- Conversely, depression may also increase the risk of developing Type 2 diabetes (Meneilly et al., 2018; Graham et al., 2021). A study of 30,360 Canadian adults between the ages of 40 and 69 found that elevated symptoms of depression “were associated with a 17% increased risk of Type 2 diabetes,” a diagnosis of depression was “associated with a 20% increased risk” and “antidepressant use was associated with a 19% increased risk” (Graham et al., 2021, p. 7). Some possible pathways between depression and type 2 diabetes could be that depression can result in an individual engaging in lower amounts of physical activity, an unhealthy diet or smoking, or alternatively, individuals with depression show increased inflammatory and stress biomarkers (Graham et al., 2021).

- **Diabetes Distress:** Older adults living with diabetes may also experience 'diabetes distress' (Dhaliwal & Weinstock, 2014), defined as "the negative emotions and burden of self-management related to living with diabetes" (Robinson et al., 2018, p. s130; Wong et al., 2017). Prolonged distress can lead to burnout and is associated with worse glycemic control and quality of life. There are large differences in the prevalence of diabetes distress, although diabetes distress impacts individuals of all ages (Skinner et al., 2020). Some research has found higher rates of diabetes distress in younger individuals when compared with older individuals (Fisher et al., 2015). However, the research outlined below signifies that a number of complex factors can increase the prevalence of diabetes distress among older adults, such as experiencing complications from diabetes (Bai et al., 2017), experiencing low income (Sidhu & Tang, 2017), and having multiple chronic health conditions and less social support (Lipscombe et al., 2015). Individuals with Type 1 diabetes have also been found to have higher rates of diabetes distress (Vallis et al., 2016). A study of 500 Canadians with diabetes found that half of those with Type 1 diabetes and a quarter of individuals with Type 2 diabetes had diabetes distress (Vallis et al., 2016).
- In a Canadian study of 323 older adults 65 years of age and older, with Type 1 diabetes duration of at least 50 years (average 54 years), the authors found overall low rates of diabetes distress (5.9%) and depression (14.3%) (Bai et al., 2017). However, older adults who were experiencing symptomatic diabetic neuropathy had a "three to four-fold higher prevalence of diabetes-related emotional distress and depression" (Bai et al., 2017, p. 1322).
- In a study of 41 South Asian adults with Type 2 diabetes living in Vancouver (participants had a mean age of 67 and 73% were women), the rate of diabetes distress was 52% and depression 15% (Sidhu & Tang, 2017). Further, 56% of participants reported a household income less than \$20,000 per year and individuals with lower incomes had higher total scores for diabetes distress and depression compared with participants who reported incomes above \$20,000 per year.
- In a Quebec study of 1,135 adults with Type 2 diabetes (average age of 60) with diabetes distress, 8% of participants had moderate or persistently severe diabetes distress over the four-year study period (Lipscombe et al., 2015). The authors found that "compared to trajectories reflecting persistently low distress, individuals in trajectories of increasing moderate and persistently severe distress tended to be older, never married, have more medical complications, poorer lifestyle habits, lower levels of perceived social support and were more likely to have comorbid major depression and anxiety symptoms" (p. 164).

Retinopathy



- Diabetic retinopathy is a serious complication of diabetes and involves damage to the retina in the eyes that can lead to vision changes or blindness, especially if left untreated (Altomare et al., 2018). Diabetic retinopathy is the number one cause of blindness in adults of working age. Diabetes Canada recommends that adults living with Type 1 diabetes without retinopathy be screened yearly, and every one to two years for adults living with Type 2 diabetes. There are several risk factors for developing retinopathy, including, but not limited to, having diabetes for a long period of time, hyperglycemia, high blood pressure and high cholesterol, and hyperglycemia (Lovshin et al., 2019).
- The Canadian Health Survey on Seniors found that in 2020, 95,300 Canadians 65 years of age and above had diabetic retinopathy (1.5% of all older adults) (Statistics Canada, 2022e). An analysis of data from the Canadian Longitudinal Study on Ageing found that older people with Type 1 and Type 2 diabetes had an increased prevalence of visual impairment (8.4% for Type 1 and 8.7% for Type 2 diabetes) compared with older adults without diabetes (5.3%) (Aljied et al., 2018).

Foot Complications



- Over time, diabetes can lead to nerve damage and poor blood flow at the level of the body's smallest blood vessels, leading to complications such as a loss of sensation, numbness or tingling in the legs or peripheral artery disease (diminished blood flow to the lower extremities) (Embil et al., 2018). Among those living with diabetes, there is a greater risk that even a minor injury may become infected and due to neuropathy, they may not feel the injury. Individuals with diabetes are at an increased risk of foot ulcers and infections. Non-healing ulcers and bone infections are common reasons why those living with diabetes may end up with amputations (Embil, et al., 2018). Diabetes Canada (2022d) states that diabetes is the leading cause of non-traumatic lower limb amputation, with approximately 70% of all non-traumatic leg and foot amputations performed in hospital being associated with diabetes.
- Foot complications from diabetes are a significant contributor to health care utilization and costs, in addition to being a factor related to morbidity and mortality from diabetes, making early, preventative foot care critical (Embil et al., 2018). Individuals living with diabetes need to have a daily foot care routine to prevent complications, which includes daily self-checks, nail care, preventing dryness and ensuring shoes fit properly (Embil et al., 2018). Some issues, such as ingrown toenails, calluses, corns or wounds, need to be treated by a foot care specialist

or doctor. The treatment of foot ulcers also requires interprofessional care, including wound management, glycemic management and customized foot off-loading devices. However, there remains a need for improved foot care screening and coverage of preventative foot care services, many of which are currently only accessible through out-of-pocket expenses, across Canada.

Palliative/

End-of-Life Care



- Palliative care may be considered for those living with diabetes at the end-of-life (Dunning & Martin, 2018), however, individuals and health care providers often lack knowledge and understanding of what end-of-life diabetes care may entail (Dunning, 2020). The presence of other health conditions (such as those discussed above) needs to be considered when providing end-of-life care for individuals with diabetes (Dunning, 2020). Based on the patient's wishes, palliative or end-of-life care for diabetes care aims to manage complications, prevent severe hypoglycemia, alleviate symptoms and preserve comfort and quality of life. Further, palliative care helps to identify individuals' and caregivers' needs and values at the end-of-life and helps ensure individuals have choice and dignity at the end-of-life. End-of-life decisions specific to diabetes include discussing withdrawing some treatment (i.e., blood glucose testing and glucose-lowering medications)

(Dunning & Martin, 2018), or reducing or changing diabetes medications to reduce complications rather than focusing on tight glycemic control (Dunning, 2020). Measuring glycemic levels is not recommended as part of end-of-life care (Meneilly et al., 2018; CADTH, 2018). Unpaid caregivers of individuals receiving end-of-life care need information and support on how to help their loved one manage diabetes care at the end of life (Dikkers et al., 2013).

- Even though diabetes is a life-limiting illness and is the seventh leading cause of death for Canadians of all ages (Statistics Canada, 2022c), there are no Canadian standards for end-of-life diabetes care (Sharma et al., 2019). There remain key gaps in the availability of palliative care across Canada, including gaps in access to palliative care, information, and national care standards (CIHI, 2018b). Few health care providers have specialized in or primarily provide palliative care and one in three unpaid caregivers report distress while caring for their loved one at home (CIHI, 2018b). A recent Canadian Institute for Health Information (CIHI) report identified that individuals who did not die of cancer and older adults were also less likely to receive palliative care (CIHI, 2018b).

Current Issues and Challenges

There is a Significant Lack of Awareness of Diabetes and its Complications

Despite many Canadians living with diabetes, there remain challenges in raising sufficient awareness of diabetes and ending the stigma associated with this chronic condition (Diabetes Canada, 2018). Individuals with diabetes may face discrimination, which can hinder efforts to improve screening and awareness (PHAC, 2022a). As Diabetes Canada (2018) states, much of the stigma related to diabetes is based on myths about Type 2 diabetes and obesity, which often places undue blame on individuals and their assumed behaviours and ignores the important role of structural, environmental and genetic risk factors in causing diabetes.

Diabetes Canada estimates that as of 2022, approximately 1.7 million Canadians were living with undiagnosed Type 2 diabetes (PHAC, 2022a).

Type 2 diabetes can be asymptomatic for many years, which increases the risk of microvascular and macrovascular complications (Hosseini et al., 2019). As such, it is important that health systems are structured in a way to ensure early diagnosis and management of diabetes. Type 1 diabetes can occur at any age; however, many clinicians may still believe that it is a disease of childhood,

putting adults at an increased risk of being misdiagnosed as Type 2 (Bao et al., 2019). This can have significant negative consequences, such as delayed treatment, particularly with insulin, which can lead to poor glycemic control.

Diabetes Canada (2023c) recommends diabetes screening every three years for all individuals over 40 years old and for those who are high-risk based on the result of a risk calculator, such as CANRISK (PHAC, 2017b). The strength of the CANRISK tool is that it is short and easy to complete, covers a range of topics and can be merged into other health assessment tools or questionnaires (Agarwal et al., 2019). A recent qualitative study of allied health organizations found that the CANRISK health promotion tool is a necessary and important way to improve diabetes risk screening (Bird et al., 2022). The study also found that there are some barriers to using the tool. For instance, the tool does not use language inclusive to all individuals, some questions can be confusing, and the tool could be improved for accessibility. The study also found that additional resources would better support the use of the tool, such as providing access to referrals for individuals with a high-risk screen. The tool has been translated into 13 languages (CPA, 2023), although the online interactive version of the tool is available only in English and French.

There is conflicting evidence regarding whether older Canadians are being adequately screened for diabetes. An

Ontario study examining the proportion of individuals who have had a delayed diagnosis or rapid onset of diabetes (using A1C levels at the time of diagnosis as a marker) found that elevated A1C levels decreased with increasing age, which could suggest older adults are being screened more appropriately than younger groups (Gim & Shah, 2019). Increased contact with a person's primary care provider was also linked to increased screening for diabetes.

However, there is evidence that some populations of older adults may still need targeted screening programs. For instance, there have been several programs that have aimed to improve diabetes screening and awareness among older adults. An example of a community-based initiative to improve the awareness and assessment of older adults for chronic diseases, including diabetes, is the Community Paramedicine Clinic CP@Clinic program, which targets older adults residing in rent-geared-to-income housing (Agarwal et al., 2016; CP@Clinic, 2022). A 2018 trial of three CP@Clinic sites found 13 of 63 participants who had high CANRISK scores and another participant had a moderate score, also had elevated capillary blood glucose level (Agarwal et al., 2018). These findings could signal that 14 residents had undiagnosed diabetes and another 50 were at risk of developing diabetes. In another community intervention, researchers examined the feasibility of piloting a Community Health Awareness Diabetes (CHAD) program, which is a program to increase the awareness of diabetes and identify high-risk individuals

to be targeted for subsequent diabetes screening by their primary care providers (Agarwal et al., 2013). The pilot study occurred in five pharmacies across Grimsby, Ont., and estimated diabetes risk through a validated screening tool, fasting capillary blood glucose and A1C level. The study found that of 588 people who participated in the program (without a diagnosis of diabetes), 84 participants (16%) were identified as being at high risk for diabetes. The majority of participants in the program were female and older adults.

There is also limited information on whether older Canadians are being adequately screened for complications related to diabetes. A recent scoping review examined diabetes foot screening practices across Canada and found that while 50% of Canadians living with diabetes have an annual foot exam, the quality of foot screening across the country is largely unknown due to a lack of up-to-date national information available on the topic (Patel et al., 2022). In the U.K., 70 to 80% of individuals with diabetes have a yearly foot exam, likely due to practice guidelines and ongoing monitoring, such as the National Diabetes Foot Care Audit (NHS, 2023). There is no equivalent program in Canada, although some provinces, such as Alberta (AHS, n.d.), Saskatchewan (SHA, 2014), Nova Scotia (Nova Scotia Health, n.d.) and P.E.I. (Government of PEI, 2023), have recognized the need to provide better diabetic foot care surveillance and limb preservation clinical care pathways (Patel et al., 2022).

There is a Need to Raise Awareness of Diabetes Complications and Improve Access to Care: The Case of Diabetic Retinopathy Screening

There is a need for improved access to screening and treatment, and awareness about diabetic retinopathy. Further to this, there is a need to remove barriers to care, such as cost and gaps in the availability of culturally safe and appropriate care.

As one of the leading causes of blindness in Canada, the consequences of not seeking regular eye assessments and care can be severe.

Even though across Canada there is partial or full coverage for older adults to receive an eye exam every year or every two years (see Appendix A), there remains barriers to obtaining regular eye care and diabetic retinopathy screening. For example, a recent study of Ontario adults over the age of 20 living with diabetes found that from 2017 to 2019, 34% of adults had not been screened for diabetic retinopathy (Felfeli et al., 2022). This is only a slight decline from the 35% of individuals not receiving a diabetic eye screenings from 2011 to 2013 (Felfeli et al., 2022). While younger cohorts had higher rates of being unscreened (58% of adults 20 to 39, and 42% of adults aged 40 to 64), 24.2% of adults 65 years of age and older had also not received an eye screening from 2017 to 2019. More than half of unscreened individuals did not have a primary care provider, and being younger, lower income, having recently immigrated

to Canada, a history of a mental health condition and living in an urban area were risk factors for being unscreened for diabetic retinopathy (Felfeli et al., 2022).

Researchers have identified several barriers to ensuring those living with diabetes are screened for diabetic retinopathy, including: socioeconomic status, geographical location (Felfeli et al., 2022), gaps in education and awareness of provincially funded services (IFA, 2017; Felfeli et al., 2019; Egunsola et al., 2021), and gaps in knowledge of health care providers regarding when to refer patients to screening programs (Egunsola et al., 2021). There is also a lack of culturally and linguistically appropriate care that can be a barrier to attending eye appointments (van Allen et al., 2021; Egunsola et al., 2021). For instance, in another recent study, researchers aimed to understand the barriers and enablers of eye screening attendance among Canadian immigrants living with Type 2 diabetes from China (Mandarin-speaking), Pakistan (Urdu-speaking) and African and Caribbean nations (French-speaking) (van Allen et al., 2021). This qualitative study of 39 participants found many consistent barriers and enablers to seeking out eye screening, such as views about harms caused by screening itself, practical issues including forgetting to make an appointment, screening costs, wait times and making/getting to an appointment, lack of awareness about retinopathy screening, language barriers, family and health care provider support, and culturally specific preferences or concerns.

How Can Screening for Diabetic Retinopathy be Improved?

Research has shown that diabetes education programs can help address gaps in retinopathy screenings. A study of older Ontarians living with diabetes found that those who participated in a diabetes education program had higher rates of attending eye appointments (78.7%) compared with those who did not attend (72.7%) (Murray & Shah, 2016). Diabetes education programs can help inform older adults about how to manage their diabetes and also provide information on diabetes complications and the importance of regular eye exams.

Another solution to increase rates of retinopathy screenings is to use tele-retinal screening, which uses technology to improve screening of “sight-threatening retinal diseases” (Felfeli et al., 2019, p. 204). There are several virtual tele-retinal screening programs across Ontario where individuals attend in person to have their eyes screened and these screenings are then sent to a specialist for review (OTN, 2023).

A novel program to improve diabetic retinopathy screening is a tele-retinal program operated within community health centres across Toronto, Ontario and aims to improve screening for diabetic retinopathy, provide education and awareness of diabetes, and also ensure patients are connected with additional eye care services (Felfeli et al., 2019). The program targets individuals with diabetes who have not had an eye screening where their pupils were dilated in the last year and are referred by their doctor or nurse practitioner (SRCHC, 2022). From 2013 to

2017, the program conducted 775 eye screenings, of which 37.1% of participants had never had an eye screening (Felfeli et al., 2019). The program identified diabetic retinopathy in 26.6% of participants, 7.4% of which were “sight-threatening” cases (p. 209). In 46.1% of screenings participants were sent for additional eye care services. A recent qualitative study of participants and providers of the program found that participants were satisfied with the program and preferred receiving the screening at their primary care site, which they trusted, had all of their information in one place and helped ensure patients had made follow-up specialist appointments (Nguyen et al., 2022). However, providers noted that there were some administrative burdens of using the program. They were concerned some individuals were still falling through the cracks, such as those who were physically unable to make it to one of the health centres to receive the screening, and there remains a need to identify proactively individuals who have not received an eye screening (i.e., by reviewing medical databases).

Patient education, improved health programs, and tele-retinopathy technology are all means to improve retinopathy screening. However, there remains a need for a province/territory wide, systematic and standardized approach to proactively identify individuals in need of diabetic retinopathy screening, notify them of how and where to obtain a screening, the cost of screening (indicating provincial/territorial coverage), and ensure follow-up to eye care specialists and primary care occurs.

The Social Determinants of Health Fuel Diabetes and its Complications

As Diabetes Canada states, “although diabetes is sometimes considered a lifestyle disease, the capacity of Canadians to live a healthy lifestyle is not equally distributed among the population” (2018, p. 6).

The social determinants of health impact the high prevalence of Type 2 diabetes, particularly among certain communities, such as Indigenous communities, and the overall management of diabetes (PHAC, 2022a).

For instance, a recent Cancer Care Ontario (CCO) and Public Health Agency of Ontario (PHO) report demonstrates that the chronic disease burden in Ontario clearly disproportionately impacts Indigenous Peoples and people living with lower socioeconomic status (2019, p. 37). The report found there were more cases, hospitalizations and deaths from diabetes in people 12 years of age and older from the lowest socioeconomic bracket compared with the highest socioeconomic bracket (p. 18). Type 2 diabetes, has been found to have a greater prevalence among Canadian’s with lower incomes, independent of other factors, such as physical activity and body weight (Dinca-Painaeitescu et al., 2011).

The ability to afford nutritious food, opportunities for physical activity and access to primary health care services are unequal across Canada and mediated by factors such as income, accessibility, racism and colonialism (PHAC, 2022a). For instance, research has found that older adults who reside in rent-geared-to-income or subsidized housing are at a heightened risk of developing Type 2 diabetes due to a combination of effects such as poverty and barriers to accessing resources and health care (Sanders & Stone, 2011; Angeles et al., 2021). A longitudinal study of older Americans also found that financial hardship was associated with worse glycemic control (Walker et al., 2020). Low income has also been associated with a higher prevalence of diabetic foot disease in an Australian study of adults over 45 years of age (Ahmed et al., 2021).

Food insecurity, often referred to as a lack of access to nutritious food, can contribute to poor health outcomes for individuals with diabetes, including worse glycemic control (Flint et al., 2020). In Canada, older adults experience lower rates of food insecurity compared to other age groups, with only 2.6% of older adults facing food insecurity in 2012 (Leroux et al., 2018). However, having a lower income, being single or living alone, women, people of colour, and not owning a home were associated with higher rates of food insecurity. The prevalence of food insecurity amongst older adults living in the territories was also much higher at 11.2%, compared to provincial rates that ranged from 2% to 3%. Older adults with incomes lower than \$20,000/year had a 54 times greater prevalence of food insecurity compared to older adults with an income

above \$60,000/year. Further to this, 93% of all cases of food insecurity were among those with incomes less than \$40,000. Thus, targeted efforts to support older adults who have low incomes, as well as other marginalized groups struggling with food insecurity are needed (Leroux et al., 2018).

Another example of how the social determinants of health can be detrimental to diabetes care and management can be clearly seen in a recent study of South Asian adults living in the Peel Region of Ontario, who both have disproportionately high rates of diabetes and experience low income (D'Silva et al., 2022). The study examined health care and community service providers' perspectives on how the social determinants of health impact Type 2 diabetes management among South Asian adults in the region, and found that racism impacted access to high-paying jobs, leading to precarious employment conditions. As a result of low pay, having multiple employers and a lack of medical benefits, individuals with diabetes faced restricted access to diabetes care (D'Silva et al., 2022).

Living with diabetes also comes with added financial costs. In Diabetes Canada's (2023b) recently published review of out-of-pocket costs associated with Type 1 and Type 2 diabetes across Canada, they found that as of September 2022, "half of all persons living with Type 1 diabetes either experience out-of-pocket costs (related to the medications, devices and supplies) in excess of 3% of their family income, or given other financial commitments, fail to adhere

to the treatment recommended by their doctor" (p. 6). Since coverage varies considerably across Canada for people living with Type 1 diabetes, annual out-of-pocket costs can range from \$78 to \$18,306. For individuals living with Type 2 diabetes, half of the provincial/territorial plans provide less than 20% coverage, and annual out-of-pocket costs can range from \$76 to \$10,014. The report also found that while government funding for low-income households is the highest, out-of-pocket costs are also the highest for them as a percentage of household income. Diabetes Canada also determined the coverage of medical supplies for Type 1 and Type 2 diabetes for older adults with household incomes greater than \$30,000 (see Figure 6 and Figure 7; all information in these figures is from Diabetes Canada, 2023b).

Public coverage for diabetes supplies in some provinces has recently improved. Manitoba recently introduced coverage for CGMs for individuals with Type 1 or Type 2 diabetes taking insulin (Government of Manitoba, 2023) and insulin pumps for individuals who meet provincial criteria (Government of Manitoba, n.d.; JDRE, 2023b). In Ontario, eligible residents with Type 1 diabetes will have varying coverage for costs associated with CGMs (Government of Ontario, 2022). In 2023, the government of New Brunswick released plans to expand their coverage of insulin pumps and CGMs for people living with diabetes (Diabetes Canada, 2023c) and Newfoundland and Labrador also released plans for a CGM pilot project (Government of Newfoundland and Labrador, 2023).

Figure 6. Type 1 Diabetes: Availability of Public Funding for Older Adults in 2022 (Diabetes Canada, 2023b)

Glossary:

F-full funding

P-partial funding

N-no funding

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	NU	NT	YT	NIHB**
Medications	P	P	P	P	P	P	P	P	P	P	F	F	F	F
Medical devices: Continuous Glucose Monitor	P	N	N	N*	N*	F	N*	N	P	N*	N	N	F	F
Medical devices: Insulin Pump	P	F	F	N*	F	N	N*	N	P	N	F	F	F	F
Device Supplies	P	F	F	P	P	N	N	N	P	N	F	F	F	F
Health Premiums	N	Y	N	N	N	N***	Y	Y	N	N	N	N	N	N

*2023 update: These provinces have recently expanded or plan to expand coverage for these devices

**Non-insured Health Benefits

*** Revenu Québec collects the annual premium through its income tax return

Figure 7. Type 2 Diabetes: Availability of Public Funding for Older Adults in 2022 (Diabetes Canada, 2023b)

	BC	AB	SK	MB	ON	QC	NB	NS	PE	NL	NU	NT	YT	NIHB
Medications	P	P	P	P	P	P	P	P	P	P	F	F	F	F
Medical devices: Continuous Glucose Monitor	N	N	N	N*	N	N	N	N	N	N	N	N	N	N
Health Premiums	N	Y	N	N	N	Y	Y	Y	N	N	N	N	N	N

*2023 update: These provinces have recently expanded or plan to expand coverage for these devices

Northwood et al. (2018) further highlight the importance of examining the social determinants of health in older adults living with multiple chronic conditions, which, as stated previously, is common among older adults living with diabetes. As the authors highlight, the challenge of supporting older adults with multiple health conditions is often viewed as a health care system problem (and thus the solution needs to be in the health care system) and does not equally take into account the importance of housing, income and sociocultural factors. A recent study by Ploeg et al. (2019) supports these findings. The researchers conducted a qualitative study of 21 older adults living with three or more chronic conditions in Ontario. An important finding of this study was that living with multiple chronic conditions led to higher costs of living due to costs associated with transportation, medications or lost income from missing work. Another qualitative study of 15 home care nurses' experiences of providing care to older adults living with Type 2 diabetes and urinary incontinence found that many older adults faced financial barriers, and these barriers impacted their ability to manage their diabetes and urinary incontinence (Northwood et al., 2021b).

It is important to highlight that there are a number of provincial and federal grants and tax rebates available to help support individuals living with chronic diseases, such as the Disability Tax Credit (Government of Canada, 2023b) and the Medical Expense Tax Credit, which covers a portion of costs related to medications, medical supplies and transportation (Government of Canada, 2023c). However,

the effectiveness of these tax credits to support older adults living with diabetes, or other chronic diseases, needs to be determined.

There is a Need to Ensure Culturally Safe and Appropriate Care in Indigenous Communities

Regardless of whether one has diabetes, Indigenous older adults face additional challenges as they age stemming from the impacts of colonialism and resultant systemic inequalities (Habjan et al., 2012; Brooks-Cleator et al., 2019). For instance, research has found that ageing in First Nations communities in Ontario can be challenging due to systemic issues such as a shortage of family caregivers, shortages in health human resources, and barriers to accessing care in rural or remote areas due to a lack of availability or the high financial cost of accessing services (Habjan et al., 2012). There are also gaps in culturally safe and appropriate care and a lack of providers who are able to communicate in Indigenous languages. Research has also found a lack of a supportive physical and social environments needed to age well in urban areas for First Nations and Inuit older adults (Brooks-Cleator et al., 2019). For instance, a qualitative study of Indigenous older adults living in Ottawa, Ontario found gaps in services and supports specifically designed for Indigenous older adults, gaps in affordable, safe and accessible transportation and housing options, and a lack of Indigenous gathering spaces (Brooks-Cleator et al., 2019).

There are systematic gaps in diabetes care for Indigenous Peoples living across different contexts in Canada (Halseth, 2019). For instance, in rural or remote areas, Halseth writes that “gaps in diabetes management and care services include limited access to community-based screening for diabetes and related infrastructure for physical exercise, complications, specialized health professionals, medicines to manage diabetes and complications, as well as culturally appropriate health services and health information” (p. 13). Indigenous people living with diabetes in urban areas also experience racism or discrimination in accessing health care, and face a lack of access to culturally appropriate care or education.

Diabetes care for Indigenous Peoples requires a specific approach to culturally safe interventions. Halseth (2019) states, “to ensure diabetes interventions are culturally appropriate, First Nations people and communities must be involved in all aspects of the research, planning and delivery of interventions as they have valuable knowledge about local conditions, assets and resources that should be used in the design and implementation of intervention” (p. 16). Further, “given that the various factors that increase the risk of type 2 diabetes among First Nations [Peoples] differ across the life course and operate at multiple levels, diabetes prevention interventions must likewise be targeted at individuals across all life stages, as well as at entire communities” (Halseth, 2019, p. 15).

In a rapid review of interventions to improve culturally safe and appropriate interventions for Indigenous communities in Canada, Australia, New Zealand and the United States, Tremblay et al. (2020) found only seven unique studies that described interventions (cultural education, culturally safe practice interventions, workplace interventions) to address diabetes care, only two of which were conducted in Canada. In a follow-up study, the authors conducted a community-based participatory qualitative study to “identify barriers and enablers to cultural safety in health care provided to Atikamekw living with diabetes in Quebec” (Tremblay et al., 2021). The authors aimed to identify suggestions to improve culturally respectful care, finding that enablers of culturally safe and appropriate care require changes at the individual to the structural level. The study specifically found barriers for Atikamekw elders who spoke limited French (Quebec’s official language) and thus had barriers accessing health care due to a lack of services in the Atikamekw language and a lack of knowledge and awareness among health care providers of the Atikamekw language and culture (Tremblay et al., 2021).

It is important to note that efforts to address diabetes care for Indigenous peoples in Canada is part of federal bill C-237, *An Act to Establish a National Diabetes Framework* (NADA, 2023). The National Indigenous Diabetes Association is currently undertaking a national engagement process as part of this much needed work.

The Challenges Facing Older Adults Living with Diabetes and Multimorbidity

There is a Need for More Interventions that Target Older Adults Living with Multimorbidity

As outlined previously, many older adults living with diabetes are also living with multiple health conditions (Griffith et al., 2019), also known as multimorbidity. However, many interventions targeting older adults focus on a singular disease, rather than multiple health conditions (Kastner et al., 2018). For older adults living with multiple chronic conditions, their caregivers and health care providers all report a need for improved health system navigation and communication (Ploeg et al., 2017a; Valaitis et al., 2020). Older adults and their unpaid caregivers may also have different goals from their health care providers and need a person-centred approach that actively involves the caregiver in developing their care plans (Kuluski et al., 2013; Ploeg et al., 2017a). Despite these challenges, there are several promising approaches that aim to overcome these gaps and improve the care for older adults living with diabetes and multiple health conditions: self-management programs, care navigation and coordination of care programs and transitions of care programs.

Self-management Programs

Self-management programs have been found to be beneficial for diabetes care and aim to encourage behaviours such as blood glucose monitoring, physical

activity and improved nutrition (Sherifali et al., 2015). Self-management programs are carried out by individuals and interprofessional diabetes care teams and aim to provide individualized care that considers an individual's needs, goals, personal circumstances (income, social support) and other health conditions. Programs that incorporate concepts of self-efficacy can support older adults in engaging in health-promoting behaviours such as exercise and diet modifications (Tan et al., 2015). A meta-analysis of diabetes self-management programs found that programs that were tailored to the needs of older adults and those that included psychological support were able to mildly reduce glycemic levels (Sherifali et al., 2015).

There are gaps in our understanding of best practices and evidence for self-management programs targeting older adults with diabetes and multiple chronic conditions (Ploeg et al., 2022). A study is currently underway in Canada to address this gap and determine the effectiveness of a self-management intervention targeting older adults living with diabetes and multiple chronic conditions (Ploeg et al., 2022). The program aims to integrate primary care and community services and also focus on the needs of older adults and their caregivers. The study builds on a multi-site pragmatic randomized control trial conducted in Ontario and Alberta that provided an interprofessional, patient-centred self-management program to older adults living with Type 2 diabetes and at least two additional chronic conditions (Markle-Reid et al., 2018). The program was tailored to the needs of participants and viewed participants as active directors of their

care program. The program consisted of in-home visits, monthly group sessions and nursing care coordination. Results from the Ontario site found that participants of the program reported greater improvements in mental health, quality of life and management of their diabetes, and reduced symptoms of depression, compared to those who received usual diabetes care.

Care Navigation and Coordination of Care Programs

Existing research shows that care coordination interventions that aim to improve communication and integration across different services (i.e., primary care, specialists, home care services) have the potential to improve patient care for older adults living with multiple health conditions (Kastner et al., 2018; Northwood et al., 2023). Care coordination frequently includes components such as ongoing communication and monitoring (Northwood et al., 2023). Similarly, there has also been an emergence of system navigation roles, often within primary care settings, that aim to address system fragmentation by communicating with various health agencies and help ensure access to care (Carter et al., 2018).

Transitions of Care Programs

Transitions between different health care settings, such as hospital to home, or home to LTC home, can be complex for older adults living with diabetes and multiple chronic conditions. A recent Ontario program targeting older adults with multimorbidity and depressive symptoms aimed to improve the quality of hospital-to-home transitions (Markle-Reid et al., 2021). The program was delivered by nurse care

coordinators that provided a minimum of two home visits and four telephone calls over six months. The care coordinator was responsible for communication among the patient's health care providers, identified and managed risk factors for depressive symptoms or other health conditions, assisted with system navigation, and provided education and support to patients and their unpaid caregivers. The trial found that of 127 participants, those in the intervention arm did not report improved mental or physical functioning, but did report having improved access to information about health and social care services. A qualitative study of care coordinators in the program found that the program required time and collaboration with other health partners to improve care coordination and is person-centred (McAiney et al., 2022).

Transitions between hospitals and LTC homes may be improved by enhancing communication between health care providers in different settings and improving health care information systems and referral pathways (Birtwell et al., 2022). For instance, having identified that antihyperglycemic medications increase the risk of experiencing challenges during transitions of care, a U.S. national taskforce assembled a list of communication elements that should be discussed between health professionals to improve transitions between care settings (Munshi et al., 2022). Some of these elements include a detailed description the patient's current medications, history of hypoglycemia, other relevant medical history, and if education was provided to patients or caregivers to support diabetes self-

management. A recent systematic review also found that following interventions designed to improve transitions between hospitals and LTC homes, such as discharge planning, education and communication interventions, individuals were 1.7 times less likely to experience readmission to hospital, had a reduced length of stay upon readmission or had fewer readmissions (Birtwell et al., 2022). However, it is important to note that the systematic review did not identify any Canadian research on this topic (and research on this topic in general is limited or of low quality), with most of the research arising from Australia and the US.

In summary, there remain key gaps in evidence supporting what may be the most successful interventions targeting older adults living with diabetes and multiple chronic conditions (Kastner et al., 2018; Northwood et al., 2023). Health care interventions rarely design programs targeting multiple health conditions (Kastner et al., 2018), particularly those that also target mental health (Northwood et al., 2023). While care coordination and system navigation has been acknowledged as an important component to improving diabetes care, there are many forms in which coordination or navigation can occur and gaps in best practices in this area (Carter et al., 2018; Northwood et al., 2023). Further, as noted by Northwood et al. (2023), there is a lack of research describing individualized care plans and a consideration of the role of unpaid caregivers, both of which are important to diabetes care for older adults. Northwood et al. (2023) also highlight that for care coordination to address the complex needs of older adults living with diabetes, awareness of community programs and

services is needed, in addition to the time for providers to connect patients to these resources. However, it is clear that further action is necessary to improve older Canadians access to integrated, multidisciplinary care programs and teams that holistically address diabetes care and other health conditions.

The recent PHAC *Framework for Diabetes in Canada* (2022a) notes there are opportunities to create better diabetes care in Canada, such as improving rural and remote health care capacity, increasing collaboration between interdisciplinary teams, improving access to virtual care and exploring options to enhance specialized patient-centred training for health care professionals. The document also stresses that patient-centred care remains central to improving care for adults living with diabetes and other chronic conditions. As these initiatives move forward, there is a need to clearly articulate how to best support older adults, their unpaid caregivers and health care providers in enacting best practices for persons living with diabetes and multiple health conditions.

Unpaid Caregivers Face Challenges Supporting Older Adults Living with Diabetes

Diabetes poses unique challenges for the unpaid caregivers of older adults living with diabetes. For example, research has found that some of the complications caused by diabetes, such as foot problems (Hoban et al., 2015; Doss & Popejob, 2022) and severe hypoglycemia (Mojdami et

al., 2020), can result in unpaid caregivers feeling stress or emotional distress. For example, an integrative review of the literature examining unpaid caregivers' experiences caring for patients with diabetic extremity wounds found that this complication disrupted routines and led to frustration, guilt, poor health care communication, helplessness and anxiety (Doss & Popejoy, 2022). In a Canadian study of 184 adults living with Type 1 or Type 2 diabetes and 140 unpaid caregivers, some caregivers experienced emotional distress following an episode of severe hypoglycemia experienced by their loved one (Mojdami et al., 2020). Severe hypoglycemia was defined as an emergency episode where the person with diabetes was unable to treat it themselves and may have been nearly unconscious, had a seizure or coma, and required the help of another person. Among caregivers of an individual with Type 1 diabetes, 41.4% of caregivers experienced helplessness, 32.9% felt unprepared and 82.9% felt scared. Among caregivers of an individual living with Type 2 diabetes, 28.6% felt helpless, 34.3% felt unprepared and 62.8% felt scared. Further, only half of all participants living with diabetes reported that they told their health care provider about the episode of severe hypoglycemia and less than half of participants did not recall regularly discussing hypoglycemia with their health care provider. These study findings suggest the need for more education and improved communication with individuals and their caregivers to better prepare them to respond to severe hypoglycemic events and support individuals following these emergencies (Mojdami et al., 2020).

Unpaid caregivers play a central role in the daily lives of older adults living with multiple chronic conditions and diabetes, even when other support services, such as home care, are in place. Unpaid caregivers may find themselves needing to take on an advocacy role due to miscommunication between health care providers and patients and play a key role in ensuring their loved ones have continuity in their care (McGilton et al., 2018). Qualitative research has found that older adults living with multiple chronic conditions depend on unpaid caregivers for support with their daily living activities, emotional and social support, and transportation needs (Ploeg et al., 2019), and that unpaid caregivers play a key role in helping them remain living in the community (Northwood et al., 2021c). One study found that while home care can help address caregiver burden, a participant pointed out that the needs and ability of their unpaid caregivers were not always taken into consideration when their eligibility for home care services was being determined (Northwood et al., 2021c).

Over the last decade or more, there has been increased awareness of the needs and perspectives of unpaid caregivers of individuals living with multiple chronic diseases (Washington et al., 2011; NIA, 2022). Research has identified the importance of information for unpaid caregivers; practical, emotional and financial support; and care coordination (Washington et al., 2011; Yedidia & Tiedemann, 2008; McGilton et al., 2018; Northwood et al., 2021c). The needs of older adults and their unpaid caregivers are often similar and include the need for

improved information, care coordination, preventive care and support, training, and person-centred care (McGilton et al., 2018). However, despite the critical role of unpaid caregivers, they remain insufficiently supported in Canada (NIA, 2022). The role and perspectives of unpaid caregivers also need to be considered when designing interventions or programs aiming to support older adults, such as those aiming to address continuity of care or transitions of care.

There are Diabetes Care Gaps for Older Adults Living in LTC Homes

There are no recent national estimates of how many older adults living in LTC homes have diabetes, however previously it has been estimated that upwards of 25% of residents living in LTC homes have diabetes (ICES, 2003). While the American Diabetes Association has previously released a position statement that outlines guidance for diabetes care in LTC settings (Munshi et al, 2016), there are currently no national standards for the management of diabetes in LTC homes in Canada. Provincially, the Diabetes Care Program of Nova Scotia released guidelines in 2019 for frail older adults living in or waiting for care in LTC homes that provide concrete guidelines and treatment recommendations related to glycemic levels (NSHA, 2019).

Care for older adults living in LTC homes is complex due to the varying needs of this population and differences in living arrangements and available supports (Munshi et al., 2016). Generally

speaking, management of LTC residents living with diabetes often includes prioritizing preventing hypoglycemia, particularly, in those with frailty or other health conditions, determining glycemic targets based on the health status of the individual and modifying insulin protocols to reduce the risk of worsening glycemic control (Munshi et al, 2016; CADTH, 2018). However, studies have shown great variation in glycemic control between LTC homes and overly aggressive glycemic control, a known driver of high mortality rates among the ageing population (Meneilly et al., 2018). Managing diabetes for those living in LTC homes can be a challenge due to differing nutritional statuses among residents, different times for meal consumption and fluid intake, cognitive functioning and its effect on communication, and a lack of training among staff on monitoring and treating diabetes. This can make it more likely that episodes of hypoglycemia and hyperglycemia in older adults living with diabetes in LTC settings are unrecognized.

Previous research has found that some LTC home care providers in Ontario may lack the time to perform diabetes care, such as conducting blood glucose tests, and an overreliance on personal support workers (PSWs) to report changes in behaviour or care, which is concerning due to gaps in diabetes related education and training (Agarwal et al., 2014). Further, providers had the view that the current system “was not flexible enough to [allow them] to provide individualized care” (Agarwal et al., 2014, p. 317). Research has also examined barriers to providing diabetes care from the perspective of medical directors and physicians of

Ontario LTC homes (Osman et al., 2016). Barriers included providing care to other residents with complicated needs, a lack of nursing time and resources, and a lack of education related to interprofessional care (Osman et al., 2016). Furthermore, ongoing and growing staffing challenges in LTC settings are only making it harder to deliver high quality diabetes care.

Several studies that have examined diabetes care in Ontario LTC homes have identified that confidence in providing and knowledge of diabetes care varied among providers, but there was also found a desire for further education (Agarwal et al., 2014; Vincent et al., 2016; Lega et al., 2020). PSWs often report the least knowledge and comfort with diabetes care (Agarwal et al., 2014; Vincent et al., 2016). However, an educational intervention targeting Ontario LTC providers successfully increased providers' confidence and knowledge of diabetes management, particularly related to hyperglycemia and hypoglycemia (Lega et al., 2020).

The Role of Technology in Supporting Older Adults Living with Diabetes and Other Health Conditions

There is a growing area of health technology to support individuals living with diabetes and their caregivers. Technology for diabetes care ranges from medical devices, such as continuous glucose monitors, and insulin pumps (Toschi & Munshi, 2020), to electronic health programs that operate through

smartphones or computers. Health technologies have been used to improve transitions of care (Whitehouse et al., 2020) and help an individual improve their self-management of diabetes (Yu et al., 2020). Health technologies associated with diabetes care are increasingly being used successfully by older adults to improve glycemic control and reduce the risk of experiencing low blood sugar (Toschi & Munshi, 2020).

Advanced Glucose Monitoring Devices

A recent advancement in diabetes technology is the use of advanced glucose monitoring devices, including continuous glucose monitors (CGM) and flash glucose monitors, which are primarily used in people with Type 1 diabetes but increasingly those with Type 2 diabetes. These wearable devices constantly measure glucose levels and some can alert individuals when they experience low or high blood sugar (Toschi & Munshi, 2020). These monitors have been shown to reduce instances of low blood sugar, including in older adults (Miller et al., 2022). CGMs have also been found to be beneficial in recording instances of asymptomatic hypoglycemia (Meneilly et al., 2018). Another benefit is often that these devices can connect to mobile apps and may allow this data to be shared with unpaid caregivers or health care providers. In combination with A1C values, the data collected by CGM can be used together to assess the level of glycemic control amongst older adults (Meneilly et al., 2018). Given the serious consequences of hypoglycemia and increased risk among older adults,

CGMs have the potential to make a marked improvement to diabetes care for older adults. There may also be the potential for CGMs to support care for older adults living in LTC homes, however, research and guidance in this area remains limited (Idrees et al., 2022). There may be some barriers to these CGMs or other new technologies as they may require troubleshooting or some individuals may find it difficult to know how to react to the results, particularly in the context of living with multimorbidity, and make decisions based on the findings (Toschi & Munshi, 2020).

CGM can also be used in conjunction with insulin pump systems. Insulin pumps and CGMs have been associated with a lessened risk of experiencing severe hypoglycemia among individuals with longstanding Type 1 diabetes (Boulet et al., 2016). An Australian study that compared two types of insulin pump/CGM systems (closed loop systems that automatically deliver insulin, versus a sensor-augmented system that requires manually dosing insulin) among older adults with Type 1 diabetes found that the closed loop system offered better glucose control and reduced instances of hypoglycemia (particularly overnight) and hyperglycemia (McAuley et al., 2022). Another study of a hybrid closed loop system also found improved glycemic control in older adults with Type 1 diabetes compared to sensor-augmented systems (Boughton et al., 2022).

A small Australian study of 30 older adults with Type 1 diabetes found that the use of insulin pumps and CGM was beneficial in enabling exercise (Chakrabarti et al.,

2022). Insulin pumps allowed participants to adjust their insulin accordingly before or after exercise. CGMs allowed participants to adjust their insulin appropriately and were less disruptive during exercise than capillary blood glucose testing. However, many participants were concerned about the risk of hypoglycemia or blood glucose variability during exercise. Another barrier to using CGMs or other technologies may be cost. For instance, five provinces or territories do not offer universal public coverage of CGM devices for older adults living with Type 1 diabetes (JDRF, 2023b; Diabetes Canada, 2023b). Given these new technologies are becoming increasingly complex, efforts should be taken to address any barriers to usage amongst older adults. However, research in this area remains sparse (Munshi et al., 2022).

Other Health Technologies

Health technologies may also be beneficial for unpaid caregivers (Ploeg et al., 2017b; Sherifali et al., 2018). For instance, reflecting on the rise of telemedicine during the COVID-19 pandemic, Blasioli & Hassini (2022) highlight the potential for technology to support unpaid caregivers by providing information or sources of peer support. In a systematic review and meta-analysis of internet interventions to support unpaid caregivers of individuals with chronic conditions, interventions that provided education and professional support were able to improve outcomes related to depression, stress and anxiety (Sherifali et al., 2018). However, there remains a need for further research in this area to improve our understanding of what interventions are the most effective (Sherifali et al., 2018).

Mobile health technologies (health technology that is delivered via mobile phones, wireless devices or patient monitoring devices) have also been used to support self-management of chronic diseases such as diabetes (Matthew-Maich et al., 2016). A scoping review of mobile health technology usage among older adults found that the usage of these devices can be quite complex, and are not a standardized solution for all older adults. The authors also argue that there is a need for a framework that considers the varying levels of support older adults living at home may require, which will range from completely independent to greater involvement of health providers or unpaid caregivers. Older adults' perceptions of the value of health technologies are also linked to usage, further stressing the importance of understanding what older adults need from these technologies.

There may also be other barriers to using technologies that aim to improve an individual's self-management of a chronic health condition (Moody et al., 2022). For instance, regardless of age, technologies that are associated with out-of-pocket costs can be challenging for those living on a low income. In a systematic review of technologies used to support the management of chronic conditions for older adults, prior experience with using a particular technology and current ability to use technologies (i.e., cognitive or functional ability) were important considerations for older adults (Moody et al., 2022). However, there remains a gap in designing and creating technologies that consider the perspective and needs of older adults. Further to this, the use of health technologies should be reassessed for older adults who have cognitive

impairments and may be unable to manage the use of the device (Toschi & Munshi, 2020).

Gaps in Research Examining Older Adults Living with Diabetes

Several recent publications and reports have clearly articulated the research gaps in understanding diabetes from the perspective of older adults and ageing. It is clear that there is a need for rigorous research specifically dedicated to understanding the most pressing issues for older adults living with diabetes, their unpaid caregivers, and health and social care providers.

To begin, there are key gaps in population health data with regard to the actual number of older Canadians who are living with diabetes. A key gap acknowledged in PHAC's recent *Framework for Diabetes in Canada* report (2022a) is that Canada lacks health data on diabetes that can be easily linked and shared across sectors (i.e., public health, population health, health system). Importantly, Canada lacks the ability to "differentiate between the types of diabetes, associated complications, comorbidities, outcomes or measures of diabetes control and to link health data to sociodemographic information and other important determinants (e.g., Indigeneity, race, income, age, employment, housing) at a national level" (PHAC, 2022a, p. 17). The benefit of improving the capability of health information systems to enhance diabetes care can be seen in jurisdictions that have created diabetes registries (see Figure 8).

Figure 8. An International Survey of Diabetes Registries

Newfoundland and Labrador (Government of Newfoundland and Labrador, n.d.; Lukewich et al., 2020)

- Launched a provincial Chronic Disease Registry in 2017
- A recent analysis of 2015/16 data from the registry was able to report on the factors associated with diabetes care by gender, age and geography, finding that more older adults were living with diabetes in rural areas, and that rural residents had worse clinical test scores compared to individuals residing in urban areas (Lukewich et al., 2020)

Sweden (NDR, n.d.):

- Launched a National Diabetes Registry in 1996
- Began with individuals with Type 1 diabetes, and expanded to include those with Type 2 diabetes
- More recent technological advancements have led to online reporting and directly transmitting information from patients' charts into the registry
- Registration is seamless
- Was originally created to support better patient care, but now provides data to support a wide range of research
- There have been some challenges educating people on the benefits that the registry has for patient care

Denmark (Jorgensen et al., 2016)

- The Danish Adult Diabetes Registry (DADR) (initially called the National Indicator Project for Diabetes) provides data from both primary care and specialist care so that treatment quality can be assessed
- All diabetes outpatient clinics have had to report records since 2004 and reporting can be done manually or through electronic records
- The annual reports separate out the indicators based on primary and secondary care and each outpatient or general practitioner (GP) has access to their own data, which allows a comprehensive overview of diabetes care
- Validity is evaluated during audits and it is estimated that the data coverage was 97% in 2014
- Data entry errors are minimized as it is noted that the majority is coming directly from electronic medical records (90% versus 10% manually)
- As it is unbiased, valid and standardized data, it can be easily used for research purposes and can be linked to other databases
- Recently, GPs stopped reporting due to changes to data protection agreements and it is integral that reporting is required again to allow a complete picture, as the majority of patients are seen by GPs

Hong Kong (Chan et al., 2019)

- The Hong Kong Diabetes Register (HKDR) was established in 1995
- The data from the HKDR is linked to the electronic medical records, which is used to predict clinical outcomes
- In 2007, the HKDR was digitized and became the web-based Joint Asia Diabetes Evaluation (JADE) Program, using risk and algorithms to create a personalized report
- In 2009, the JADE Program was adapted to form the Risk Assessment and Management Program for Diabetes Mellitus (RAMP-DM) in publicly funded primary care clinics, which was able to reduce major events by 30-60% in patients without complications

United States (T1D Exchange, 2023)

- The T1D Exchange is an opt-in longitudinal research registry that aims to better understand the experiences and needs of those with Type 1 diabetes
- There are currently over 18,000 people registered
- The registry collects research data directly from individuals and through CGM devices
- Findings from the registry have led to improvements in care related to coverage for blood glucose testing strips, changes to pediatric glycemic guidelines, and coverage for CGM devices

Munshi et al. (2020) further identify that there are many research gaps as they relate to older adults living with diabetes. For example, the authors highlight that there are currently no guidelines that consider the severity or combination of comorbid conditions in determining appropriate glycemic targets for older adults. There remain gaps in clinical decision-making tools and outcome measures to ensure that older adults are being treated to a glycemic target that considers their disease risk, quality of life, and functional ability. Further to this, there are gaps in understanding the frequency of hypoglycemia amongst older adults, in addition to its impact on quality of life. There are also considerable gaps in how to best care for older adults living with diabetes in LTC homes or who are receiving palliative care, in addition to differences with respect to knowledge and care for those with type 1 versus type 2 diabetes (Munshi et al., 2020).

Sinclair et al. (2018) further highlight key gaps in research regarding older adults living with diabetes in LTC homes. In their review of the literature and guidelines on diabetes care in LTC homes, the authors found that there was only moderate evidence describing the characteristics of older people living with diabetes residing in LTC homes and only limited evidence investigating the quality of diabetes care, care home policies and outcomes for this group of older adults. The authors also found limited evidence for recommendations in clinical guidelines and given limited research evidence available, recommendations rely on expert consensus. Sinclair et al. (2018) call for improved research and awareness

regarding older adults living with diabetes while in LTC settings.

There is also a need for research examining older adults and diabetes to adopt an equity lens. As stated by Prinjha et al. (2022): “diabetes cannot be understood purely by research into biological and lifestyle factors. Significant social determinants of health (SDOH), such as income, employment and housing, play a critical role yet remain understudied. Indigenous, racialized, LGBTQ2S and low-income communities are disproportionately impacted by diabetes” (p. 549). Canada has not substantially addressed how racism mediates health inequalities when compared with social determinants of health like income or education levels (Datta et al., 2021) and there is a need for further gerontological research using an intersectional lens and to examine key issues such as racism, gender and poverty (Foster et al. 2022).

The NIA also found gaps in research and data regarding the prevalence of diabetes and comorbid conditions (e.g. how many adults have both diabetes and dementia, diabetes and depression) and the incidence and prevalence of diabetes complications by age (age at onset, repeat episodes, severity, outcomes), and overall a lack of research that examines age in narrower increments, such as every five years, which would allow for more precise assessment of changes to diabetes across the life course. These challenges are critical to address because they would help identify core areas of need and identify which and how many Canadians of all ages would be impacted

by interventions targeting these issues. Nevertheless, there has been promising work underway to identify important potential areas of research for older adults living with diabetes. Diabetes Action Canada (DAC) is a leading research organization that aims to integrate diabetes researchers with patients and their unpaid caregivers, health care providers and health organizations (DAC, 2023). DAC has a research stream dedicated to older adults living with diabetes, and has also embarked on other key projects in the areas of diabetic retinopathy, foot care and mental health, among others.

While there is less research on older adults living with Type 1 diabetes, the Canadian Study of Longevity in Type 1 Diabetes has conducted numerous studies that address some of these gaps. These research studies examined individuals who have had Type 1 diabetes for more than 50 years (often diagnosed in childhood) and thus most participants were over 60 years old (Lewis et al., 2022). These studies have examined the impact of Type 1 diabetes on cardiovascular risk (Lovshin et al., 2018), diabetes complications such as neuropathy (Lewis et al., 2022) and retinopathy (Lovshin et al., 2019), and related topics such as diabetes technologies (Boulet et al., 2016), bone density (Alhuzaim et al., 2016) and autoimmune disease (Cardinez et al., 2021). The studies have also provided insights into the biological mechanisms that contributed to a small number of older adults living for decades with Type 1 diabetes with minimal complications, which can pave the way for future interventions to reduce these

complications (Perkins et al., 2021). The researchers identified key areas of future research, such as heart complications, bone health, joint mobility, diabetes distress and mental health, dementia risk and overcoming gaps in the research related to survivor and selection biases.

Several recent papers have determined key priorities for diabetes research in Canada. Sherifali & Meneilly (2016) discuss the results of a national workshop, the first of its kind, that looked to identify key research, education and clinical management priorities to improve the management of diabetes in older adults. Around 30 participants (clinicians, educators, decision-makers, policymakers and researchers from Canada) attended an interactive two-day meeting that included expert presentations and group consensus building using an electronic meeting system as well as nominal group techniques.



The results of the two-day meeting found five themes of research (each with 14 sub-questions), which included identifying:

1. “What are the relevant outcomes for diabetes in older adults from the perspectives of patients, providers and decision makers and policy makers?”
2. What are the roles and impacts of early detection and prevention of diabetes in older adults?
3. What is the impact of living with diabetes (and possibly other comorbidities) on older adults and their family/friends and/or unpaid caregivers?
4. What are the most effective and efficient assessment tools to assess risk in older adults [living] with diabetes?
5. What are the most effective models of healthcare delivery for older adults [living] with diabetes?” (Sherifali & Meneilly, 2016, p. 33).

While not specific to older adults, another recent Canadian study aimed to determine the research topics that are most important to people living with or caring for someone living with any type of diabetes (Dogba et al., 2018). The study surveyed 469 people living with diabetes or caregivers of people living with diabetes to rank the importance of 10 research topics that were predetermined by a literature review and expert consultation. The study also conducted three focus groups in Quebec to examine the perspectives of people under-represented in diabetes research, such as older adults, people who experience low income and individuals who had recently immigrated to Canada. The study found that for both survey

and focus group participants, the prevention and treatment of kidney, eye and neurological complications caused by diabetes were viewed as important. Participants also wanted research about “bidirectional influence of life context on diabetes” (p. 554), such as how individual experiences and broader factors, such as socioeconomic status, impact the management of diabetes. Lastly, the study found that participants wanted more research on historically marginalized and under-represented communities and the need for culturally safe and appropriate care (Dogba et al., 2018). The findings from this study were used to inform the CIHR-funded research program of Diabetes Action Canada (DAC) and the pan-Canadian Strategy for Patient-Oriented Research Network on Diabetes (2016-26). As a result, people living with diabetes became involved as patient partners in this network, co-designing, implementing and evaluating research projects, and supporting network governance (DAC, 2023).

In summary, there is immense potential for academic and applied research to improve our understanding of how to address key concerns and improve health outcomes for older adults living with diabetes. Work is already underway across Canada to address some of these key gaps, but far more is needed to address knowledge and care gaps.

A Call to Action to Better Understand and Support Older Canadians Living with Diabetes

To address the challenges described in this report, the NIA calls for immediate national and provincial/territorial action to improve diabetes care across Canada through 4 evidence-informed recommendations:

1. The Canadian federal, provincial and territorial governments need to ensure that diabetes health strategies and research on diabetes include a focus on appropriately recognizing and addressing the unique issues and needs of older Canadians living with diabetes and their caregivers and fully engage them in this work.

As outlined throughout this report, ageing with diabetes comes with complex challenges and unique considerations that are not always given sufficient attention. Without acknowledging these unique considerations, the needs and experiences of older adults living with diabetes risk being overlooked or under-explored, which could lead to suboptimal health outcomes or quality of life for older people with diabetes. Current and future diabetes health strategies need to include a focus on the issues and needs of older people living with Type 1 and Type 2 diabetes and how to appropriately address them.

There are several key areas where additional research and data collection are needed to ensure that future health strategies or models of care for older adults with diabetes are informed by the most up-to-date and rigorous evidence. There is a need for future research specifically aimed at understanding how diabetes impacts older adults as a diverse group of individuals with varying needs and care requirements based on the presence of other health conditions, personal circumstances and socioeconomic factors. There are key gaps in best practices that support models of care that focus on care coordination, transitions of care, multimorbidity, mental health and diabetes care in LTC (home and community care, and LTC homes). Differentiating between the experiences and needs of older adults living with Type 1 versus Type 2 diabetes should also be considered. Lastly, as identified in existing research agendas (Dogba et al., 2018), diabetes research must continue to adopt a person and caregiver-centred view and ensure meaningful engagement with individuals living with diabetes and their unpaid caregivers.

2. The Canadian federal, provincial and territorial governments need to create national health information systems that address gaps in our understanding of the prevalence and incidence of diabetes and diabetes complications among older Canadians. Secondly, there is a need to improve mechanisms for reporting and screening through provincial/territorial registries.

Canada lacks a comprehensive understanding of the prevalence and incidence of diabetes and its complications. There is no nationwide health data on health complications from or related to diabetes (e.g. diabetic retinopathy) that describes trends over time or health outcomes associated with these conditions. Existing diabetes disease surveillance systems, such as the Canadian Chronic Disease Surveillance System, are not able to provide a comprehensive or consistent view of the impact of diabetes across Canada, do not differentiate between types of diabetes, and are not able to integrate health data across various settings and sources (Diabetes Canada, 2018).

To address these challenges, data systems should:

- Include data on older adults living with diabetes to provide breakdowns by age categories (e.g., 65-75, 75-85, 85 and older), allowing for an analysis of age-related

differences. Data collection should also include variables including but not limited to: gender identity, sex, race/ethnicity, socioeconomic status (income, education), immigration/citizenship variables, language and geography.

- Ensure that national, provincial or territorial data sources are available for research and quality improvement processes.
- Create mechanisms at the provincial or territorial level to proactively identify individuals in need of screening for complications from diabetes (e.g., retinopathy, foot problems) and ensure referrals are made to comprehensive primary care-led support and interprofessional and specialist services. The creation of a diabetes registry at the provincial/territorial level can proactively identify individuals who are in need of screening for diabetes complications, provide information about where to obtain the screening, ensure referrals are made to health providers and other relevant care services (i.e. foot care services), and track outcomes related to diabetes complications. As part of diabetes care for older adults, screening for complications from diabetes, such as foot or eye complications, should be integrated with the routine provision of primary and specialist care that can prevent the development of these complications through improved early treatment or medications.

- Provinces, such as Ontario and Newfoundland and Labrador, can draw on their existing infrastructure and experience with cancer registries (e.g. Cancer Care Ontario/Ontario Health) that provide a model for implementing a diabetes registry and screening program. For instance, the Ontario Health/Cancer Care Ontario registry includes a program that sends individuals a letter when they need cervical cancer screening, among other follow-up letters (Cancer Care Ontario, n.d.). This means of communication can be replicated for diabetes complications, such as diabetic retinopathy screening. Newfoundland and Labrador have also improved their provincial surveillance of chronic diseases through the creation of the Chronic Disease Registry in 2017 (Government of Newfoundland and Labrador, n.d.; Lukewich et al., 2020) that could be leveraged to create a provincial diabetes registry. There also several international examples of successful registries, that aim to improve those countries' understanding of the health of individuals living with diabetes, improve health outcomes and aid research (see Figure 8).

3.The Canadian federal, provincial and territorial governments need to prioritize improvements to health and social care system navigation, care integration and transitions of care for older adults living with diabetes and their caregivers. Health and social system improvements should consider the role of comprehensive primary care-led support and clinical pathways with appropriate interprofessional and specialist supports, and be centered around the needs and perspectives of older adults and their unpaid caregivers.

Provincial health care systems are complicated to navigate, there are many overlapping programs and services, and transitioning between settings can be poorly managed. Older adults living with diabetes and their unpaid caregivers are trying to navigate the health system not only for their diabetes care and subsequent complications, such as foot or eye care, but also often for many other health conditions. Older adults and their unpaid caregivers may find themselves navigating hospital and specialist care, home and community care and other community-based programs and supports simultaneously. In light of gaps in best practices and programs that aim to

improve health system navigation or coordination (Northwood et al., 2023) and transitions of care, there remains an urgent need to prioritize improvements to these areas of care.

Importantly, the perspectives and needs of older adults and their unpaid caregivers need to be central in all discussions about how to improve health system navigation and integration. Primary care providers will play a central role in health system integration and coordination, alongside an interprofessional approach given the wide range of expertise and services needed to support older adults living with complex health needs. Care coordination must also consider the home and community care and mental health care sectors. Care for complications from diabetes, such as foot and eye conditions, would also benefit from an interdisciplinary and integrated approach to care. Technology and digital tools may be helpful support aids in enabling improved diabetes care and self-management, however, they need to be tailored to the needs, care goals and ability of older adults and their unpaid caregivers.

The NIA has previously developed a number of comprehensive policy recommendations to support older adults and their caregivers age in their location of choice, many of which are directly applicable to those living with diabetes (see Figure 9). These include strengthening our home and community care systems, establishing health navigator roles, and improving supports for unpaid caregivers.

4. Current and future efforts to better address diabetes care must be viewed through a social determinants of health lens. Provincial and territorial governments need to ensure that diabetes prevention and ongoing care are appropriately covered and supported through our publicly funded health and social care systems.

Despite increased awareness of the importance of the social determinants of health, there is a continued need for interventions to address these structural factors that impact health. Canada has historically adopted a “biomedical and individualized approach towards promoting health,” which focuses on individual behaviour change and downplays the importance of ensuring health, economic and social systems are equitable and address upstream determinants of health (Medvedyuk & Raphael, 2018, p. 574). While systemic inequalities are challenging to address, they have the greatest potential to improve health outcomes and address equity issues (Ogunwale & Golden, 2021). Therefore, it is imperative that efforts aimed at improving diabetes care are viewed through this lens. For example, it is essential to consider the impact of housing, transportation, social support and poverty on diabetes care.

Diabetes impacts all facets of life, and out-of-pocket costs related to food, exercise, home and community care, caregiver support and transportation can quickly add up. Older adults who have lower incomes may not be able to afford out-of-pocket expenses or may be forced to make trade-offs in order to cover expenses. Provincial and territorial governments need to ensure that publicly funded health and social care systems are able to cover and support diabetes prevention and ongoing care. Further, while a number of provincial and federal tax credits and grants exist, older adults and their families may not know these programs exist, or struggle to access them. There is also a need for these initiatives to also be evaluated to determine if they are meeting their intended goals and identify ongoing gaps in coverage.

As described in Figure 9, the NIA has previously advocated many improvements to Canadian health and LTC services, housing, transportation, and support for unpaid caregivers, that would benefit not only older adults living with diabetes, but older Canadians more broadly. Many aspects of these recommendations aim to directly or indirectly address the social determinants of health, such as by improving individuals' access to medical appointments via accessible and flexible public transportation options, ensuring older Canadians have adequate levels of home and community care, and providing better financial support for unpaid caregivers.



Figure 9. The NIA's Recommendations to Support Canada's Ageing Population to Age in the Right Place

The NIA has previously written in depth about how to better support many Canadians in later life (see NIA, 2020, NIA, 2022). Of these recommendations, the following are the most applicable to the challenges that older adults living with diabetes face:

Provide adequate and sustainable LTC funding: Canada's ageing population is increasing the demand for home and community care and LTC homes. Canada lags behind other countries in its expenditures related to LTC. Improving the provision of LTC and ageing-in-place initiatives and strengthening and enforcing LTC home standards will ensure not only that there are enough resources to care for older Canadians, but also that these services are of high quality.

Expand home and community care services: Canada needs to adopt a deliberate public policy response that shifts more LTC resources from the provision of institutional care to home care and community support services and ensures that only individuals requiring care in LTC homes are admitted to them. It will be imperative to implement care models and policies that enable more older Canadians to live at home and in their communities with greater independence.

Establish community-care navigator roles: Navigators can ensure that older adults needing LTC receive timely, appropriate care and have opportunities to remain engaged in their communities. Navigators can coordinate and design care plans between different types of care and services (including social services) at a local level, ensuring that older adults receive the most appropriate care available in their areas.

Housing: There is a need to enable local governments and stakeholders to provide more inclusive, accessible and safe housing options in addition to LTC homes. There is a shortage of accessible housing options across Canada, particularly for lower-income Canadians. Further, not all Canadians may be aware of home renovation tax credits that may help them modify their homes to allow them to age safely at home. New, innovative housing models, such as co-housing, HomeSharing or Naturally Occurring Retirement Community programs also have the potential to provide more housing options to older adults that incorporate various degrees of health and social supports. There are a range of federal and provincial tax credits, grants and benefits to support ageing at home, including the Home Accessibility Tax Credit, which provides support for home modifications for adults 65 years of age and older for those who are eligible for the Disability Tax Credit (Government of Canada, 2023d). However, there is variation between provinces with respect to coverage to support home modifications or renovations.

Transportation: There is a need to support greater investments in more accessible and flexible transportation options. The baby boomer generation has historically been dependent on their vehicles, which raises concerns about how older adults will remain able to access day-to-day amenities once they can no longer drive. Across Canada, there are many gaps in public transportation, and there is a need for alternative transportation options that are accessible and inclusive.

Social Isolation: Social isolation is a growing concern among Canadians, and there is a need to integrate screening and solutions for social isolation and loneliness into the delivery of health care, home care and community support services. Models of care should also consider building in opportunities for social engagement and other social programs.

Improve financial and non-financial supports for unpaid caregivers: Unpaid caregivers are an invaluable resource for older Canadians. However, caregiving comes with stressors and challenges, such as the financial cost of caring for a loved one. Many caregivers may also be unaware of the benefits available to them through provincial tax credits and benefits, such as the Canada Caregiver Credit (Government of Canada, 2023e). While there are some tax credits available at the provincial level (see Manitoba, Nova Scotia and Quebec), there remains no formal process for unpaid caregivers to have their needs assessed and recognized separate from the care recipient and no minimum standards for support for unpaid caregivers.



Conclusion

Diabetes is a serious, life-altering chronic disease that imposes a disproportionately high burden on older Canadians (Government of Canada, 2023a).

Concerningly, across all ages, cases of diagnosed Type 1 and Type 2 diabetes are anticipated to rise 27% by 2032 (Diabetes Canada, 2022a). Among older adults, Type 1 diabetes cases will nearly double by 2040 (T1D Index, 2023). As Canada sees more individuals than ever before ageing with diabetes, there remains an urgent need to tackle key issues related to the provision of diabetes care.

Although individuals of all ages experience challenges and complications associated with diabetes, older adults face additional obstacles due to managing multiple health conditions (Griffith et al., 2019). They have an increased risk of experiencing a serious emergency, such as severe hypoglycemia, and as their health status changes, need a more individualized approach to managing their diabetes (Meneilly et al., 2018).

Even though new technologies have transformed diabetes care, they are often created without considering older adults' perspective or user experience. It remains to be seen how to support the safe implementation of new technologies in settings like LTC homes or for older adults with declining physical or cognitive health (Toschi & Munshi, 2020; Moody et al., 2022). Moreover, there are also significant gaps in knowledge and guidelines to support the delivery of optimal care for individuals living with diabetes in LTC homes or for those receiving palliative care (Munshi et al., 2020).

This report describes an overall lack of acknowledgement, consideration, and action regarding many of these issues in Canada. Consequently, many of the challenges faced by older adults living with diabetes and their unpaid caregivers remain silent in conversations aimed at improving diabetes care. To address the challenges described in this report, the NIA calls for immediate national and provincial/territorial action to improve diabetes care across Canada. In doing so, this report recommends that current and future health strategies include a focus on the unique needs of older adults living with diabetes, the creation of mechanisms for the proactive screening and management of diabetes complications and improved data reporting, the prioritization of integrated and multidisciplinary models of care, and a renewed focus on addressing the upstream social determinants of health.

Appendix A. Provincial Government Health Coverage for Eye Exams for Canadians 65+

Province/Territory	Eye Exam Coverage
Yukon	Extended Health benefits assist with the cost of eye care ¹
Nunavut	Inuit Land Claim Beneficiaries are eligible for an eye exam every 2 years. Extended health benefits may assist with the cost of eye care for non-Indigenous older adults ²
NWT	Yearly eye exam coverage ³
British Columbia	Partial coverage for yearly eye exams ^{4,5}
Alberta	Complete eye exam, partial exam, and one diagnostic procedure per year ⁶
Saskatchewan	Yearly eye exam ⁷
Manitoba	Exam every two years ⁸ . Additional screening for diabetic retinopathy screening may be available yearly. ⁹
Ontario	Yearly eye exam, plus any follow-up ¹⁰
Quebec	Yearly eye exam coverage ¹¹
Newfoundland & Labrador	\$55 towards the cost of a routine eye exam every 36 months for adults under Income Support or case by case ¹²
New Brunswick	Yearly exam for individuals with diabetes ¹³
Nova Scotia	Routine eye exam every two years; yearly non-routine exam for individuals with diabetes ¹⁴
Prince Edward Island	One diabetic eye exam (coverage for dilated exam only, not a complete eye exam) is covered per year for patients with type 1 diabetes and every two years for patients with type 2 diabetes ¹⁵

- ¹ Government of Yukon. (n.d.). Apply for extended health care benefits and Pharmacare for seniors. Retrieved April 18, 2023 from <https://yukon.ca/en/health-and-wellness/care-services/apply-extended-health-care-benefits-and-pharmacare-seniors>
- ² Government of Nunavut. (2023). Extended Health Benefits Seniors Coverage. Retrieved April 28, 2023 from <https://www.gov.nu.ca/health/information/extended-health-benefits-ehb-seniors-coverage>
- ³ Northwest Territories Health and Social Services Authority. (n.d.). Eye Clinic-Ophthalmology Services. Retrieved April 28, 2023 from <https://www.nthssa.ca/en/services/eye-clinic-%E2%80%93-ophthalmology-services>
- ⁴ Province of British Columbia. (n.d.). Optical Coverage. Retrieved April 18, 2023 from <https://www2.gov.bc.ca/gov/content/family-social-supports/income-assistance/on-assistance/supplements/optical>
- ⁵ BC Doctors of Optometry. (2023). Medical Services Plan. Retrieved April 28, 2023 from <https://bc.doctorsofoptometry.ca/patients/medical-services-plan/>
- ⁶ Government of Alberta. (2023). Health Care Services Covered in Alberta. Retrieved April 28, 2023 from <https://www.alberta.ca/ahcip-what-is-covered.aspx>
- ⁷ Saskatchewan (2023). Partially Covered Services. Retrieved April 28, 2023 from <https://www.saskatchewan.ca/residents/health/prescription-drug-plans-and-health-coverage/health-benefits-coverage/partially-covered-services>
- ⁸ Extended Health and Dental Insurance. (2020). Manitoba Provincial Health Insurance Plan. Retrieved April 18, 2023 from <https://extendedhealthcanada.ca/manitoba-health-insurance>
- ⁹ Misericordia Health Centre. (2023). Manitoba Retinal Screening Vision Program. Retrieved April 28, 2023 from <https://misericordia.mb.ca/programs/acute-care/eye-care/mrsvp>
- ¹⁰ Government of Ontario. (2017). What OHIP Covers. Retrieved April 28, 2023, from <https://www.ontario.ca/page/what-ohip-covers#section-6>
- ¹¹ Government of Québec. (n.d.). Optometric services. Retrieved April 18, 2023 from <https://www.ramq.gouv.qc.ca/en/citizens/health-insurance/optometric-services>
- ¹² Government of Newfoundland and Labrador. (n.d.). Health Related Services - Children, Seniors and Social Development. Retrieved April 18, 2023 from <https://www.gov.nl.ca/cssd/income-support/healthservices/>
- ¹³ Government of New Brunswick. (n.d.). Health Services Vision Program. Retrieved April 18, 2023, from https://www2.gnb.ca/content/gnb/en/services/services_renderer.7975.Health_Services_Vision_Program_.htm
- ¹⁴ Nova Scotia. (2018). Department of Health & Wellness: Optometry Programs. Optometrists Guide April 2018. Retrieved April 28, 2023, from <https://novascotia.ca/dhw/optometry-programs/Optometry-Guide.pdf>
- ¹⁵ Prince Edward Island Association of Optometrists. (2019). Diabetic Eye Exams. <https://peioptometrists.com/diabetic-eye-exams>

References

- Ahmed, M. U., Tannous, W. K., Agho, K. E., Henshaw, F., Turner, D., & Simmons, D. (2021). Social determinants of diabetes-related foot disease among older adults in New South Wales, Australia: evidence from a population-based study. *Journal of Foot and Ankle Research, 14*(1), 1-18.
- Agarwal, G., Kaczorowski, J., & Hanna, S. (2013). Community Health Awareness of Diabetes (CHAD): Description of a Community-Wide Diabetes Awareness Demonstration Program and its Feasibility. *Canadian Journal of Diabetes, 37*(5), 294-300.
- Agarwal, G., Sherifali, D., Kaasalainen, S., Dolovich, L., & Akhtar-Danesh, N. (2014). Nurses' perception and comfort level with diabetes management practices in long-term care. *Canadian Journal of Diabetes, 38*(5), 314-319.
- Agarwal, G., Angeles, R., Pirrie, M., Marzanek, F., McLeod, B., Parascandalo, J., & Dolovich, L. (2016). Effectiveness of a community paramedic-led health assessment and education initiative in a seniors' residence building: the Community Health Assessment Program through Emergency Medical Services (CHAP-EMS). *BMC emergency medicine, 17*(1), 1-8.
- Agarwal, G., Angeles, R., Pirrie, M., McLeod, B., Marzanek, F., Parascandalo, J., & Thabane, L. (2018). Evaluation of a community paramedicine health promotion and lifestyle risk assessment program for older adults who live in social housing: a cluster randomized trial. *CMAJ, 190*(21), E638-E647.
- Agarwal, G., Pirrie, M., Angeles, R., Marzanek, F., & Parascandalo, J. (2019). Development of the Health Awareness and Behaviour Tool (HABiT): Reliability and suitability for a Canadian older adult population. *Journal of Health, Population and Nutrition, 38*, 1-11.
- Alberta Health Services. (n.d.) Pathway toolkit - Diabetes Foot Care Clinical Pathway. Retrieved March 27, 2023 from <https://www.albertahealthservices.ca/scns/Page10321.aspx>
- Alhuzaim, O. N., Lewis, E. J., Lovblom, L. E., Cardinez, M., Scarr, D., Boulet, G., ... & Perkins, B. A. (2019). Bone mineral density in patients with longstanding type 1 diabetes: results from the Canadian Study of Longevity in Type 1 Diabetes. *Journal of Diabetes and its Complications, 33*(11), 107324.
- Allen, N. A., Litchman, M. L., Chamberlain, J., Grigorian, E. G., Iacob, E., & Berg, C. A. (2022). Continuous Glucose Monitoring Data Sharing in Older Adults With Type 1 Diabetes: Pilot Intervention Study. *JMIR Diabetes, 7*(1), e35687. Doi: 10.2196/35687.
- Aljied, R., Aubin, M. J., Buhrmann, R., Sabeti, S., & Freeman, E. E. (2018). Prevalence and determinants of visual impairment in Canada: cross-sectional data from the Canadian Longitudinal Study on Aging. *Canadian Journal of Ophthalmology, 53*(3), 291-297.

- Almirall, J., & Fortin, M. (2013). The coexistence of terms to describe the presence of multiple concurrent diseases. *Journal of Comorbidity*, 3(1), 4-9.
- Altomare, F., Kherani, A. & Lovshin, J. (2018). Retinopathy: Diabetes Canada Clinical Practice Guidelines Expert Committee. *Canadian Journal of Diabetes*, 42, s210-s216.
- Alvarez, C. A., Lingvay, I., Vuylsteke, V., Koffarnus, R. L., & McGuire, D. K. (2015). Cardiovascular risk in diabetes mellitus: complication of the disease or of antihyperglycemic medications. *Clinical Pharmacology & Therapeutics*, 98(2), 145-161.
- Angeles, R., Zhu, Y., Pirrie, M., Marzaneq, F., & Agarwal, G. (2021). Type 2 diabetes risk in older adults living in social housing: a cross-sectional study. *Canadian Journal of Diabetes*, 45(4), 355-359.
- Bai, J. W., Lovblom, L. E., Cardinez, M., Weisman, A., Farooqi, M. A., Halpern, E. M., ... & Perkins, B. A. (2017). Neuropathy and presence of emotional distress and depression in longstanding diabetes: results from the Canadian study of longevity in type 1 diabetes. *Journal of Diabetes and its Complications*, 31(8), 1318-1324.
- Banasiak, K., Cleary, D., Bajurny, V., Barbieri, P., Nagpal, S., Sorensen, M., ... & Senior, P. (2020). Language matters—a Diabetes Canada consensus statement. *Canadian Journal of Diabetes*, 44(5), 370-373.
- Ballios, B. G., Park, T., Chaudhary, V., Hurley, B., Kosar, S., Sheidow, T., ... & Wong, D. T. (2021). Identifying gaps in patient access to diabetic screening eye examinations in Ontario: a provincially representative cross-sectional study. *Canadian Journal of Ophthalmology*, 56(4), 223-230.
- Bao, Y. K., Ma, J., Ganesan, V. C., & McGill, J. B. (2019). Mistaken identity: missed diagnosis of type 1 diabetes in an older adult. *Medical research archives*, 7(8).
- Berlie, H. D., & Garwood, C. L. (2010). Diabetes medications related to an increased risk of falls and fall-related morbidity in the elderly. *Annals of Pharmacotherapy*, 44(4), 712-717.
- Bird, M., Cerutti, S., Jiang, Y., Sruogo, S. A., & de Groh, M. (2022). Implementation of the CANRISK Tool: A Qualitative Exploration Among Allied Health Professionals in Canada. *Canadian Journal of Diabetes*, 46(2), 118-125.
- Biessels, G. J., & Whitmer, R. A. (2020). Cognitive dysfunction in diabetes: how to implement emerging guidelines. *Diabetologia*, 63, 3-9.
- Birtwell, K., Planner, C., Hodkinson, A., Hall, A., Giles, S., Campbell, S., Tyler, N., Panagioti, M., & Daker-White, G. (2022). Transitional Care Interventions for Older Residents of Long-Term Care Facilities: A Systematic Review and Meta-Analysis. *JAMA Network Open*, 5(5), e2210192. Doi: 10.1001/jamanetworkopen.

Blasioli, E., & Hassini, E. (2022). e-Health Technological Ecosystems: Advanced Solutions to Support Informal Caregivers and Vulnerable Populations During the COVID-19 Outbreak. *Telemedicine and E-Health*.

Boughton, C. K., Hartnell, S., Thabit, H., Mubita, W. M., Draxlbauer, K., Poettler, T., ... & Hovorka, R. (2022). Hybrid closed-loop glucose control compared with sensor augmented pump therapy in older adults with type 1 diabetes: an open-label multicentre, multinational, randomised, crossover study. *The Lancet Healthy Longevity*, 3(3), e135-e142.

Boulet, G., Halpern, E. M., Lovblom, L. E., Weisman, A., Bai, J. W., Eldelekli, D., ... & Perkins, B. A. (2016). Prevalence of insulin pump therapy and its association with measures of glycemic control: results from the Canadian study of longevity in type 1 diabetes. *Diabetes technology & therapeutics*, 18(5), 298-307.

Bremer, J. P., Jauch-Chara, K., Hallschmid, M., Schmid, S., & Schultes, B. (2009). Hypoglycemia unawareness in older compared with middle-aged patients with type 2 diabetes. *Diabetes Care*, 32(8), 1513-7.

Brooks-Cleator, L. A., Giles, A. R., & Flaherty, M. (2019). Community-level factors that contribute to First Nations and Inuit older adults feeling supported to age well in a Canadian city. *Journal of aging studies*, 48, 50-59.

Butler, A. E., & Misselbrook, D. (2020). Distinguishing between type 1 and type 2 diabetes. *BMJ*, 370.

CADTH. (2018). Summary of Abstracts: Management of Diabetes in Long-term Care Facilities. Retrieved March 1, 2023 from <https://www.cadth.ca/sites/default/files/pdf/htis/2018/RB1238%20LTC%20Diabetes%20Management%20Final.pdf>

Canadian Institute for Health Information. (2018a). Unpaid caregiver challenges and supports. Retrieved Nov. 15, 2022 from <https://www.cihi.ca/en/dementia-in-canada/unpaid-caregiver-challenges-and-supports>

Canadian Institute for Health Information. (2018b). Access to Palliative Care in Canada. Retrieved May 1, 2023 from https://secure.cihi.ca/free_products/access-palliative-care-2018-en-web.pdf

Canadian Institute for Health Information. (2022). Overview: Impact of COVID-19 on healthcare providers. Retrieved Nov. 23, 2022 from <https://www.cihi.ca/en/health-workforce-in-canada-in-focus-including-nurses-and-physicians/overview-impacts-of-covid-19-on>

Canadian Pharmacists Association. (2023). CANRISK Tools. Retrieved from <https://www.pharmacists.ca/advocacy/practice-development-resources/canrisk-tools/>

Cancer Care Ontario and Ontario Agency for Health Protection and Promotion (Public Health Ontario). (2019). The burden of chronic diseases in Ontario: key estimates to support efforts in prevention. Toronto: Queen's Printer for Ontario.

Cancer Care Ontario. (n.d.). Cervical Screening. Retrieved May 1, 2023 from <https://www.cancercareontario.ca/en/types-of-cancer/cervical/screening>

Cardinez, N., Lovblom, L. E., Orszag, A., Cherney, D. Z., & Perkins, B. A. (2021). The prevalence of autoimmune diseases in longstanding diabetes: results from the Canadian study of longevity in adults with Type 1 Diabetes. *Canadian Journal of Diabetes*, 45(6), 512-518.

Carter, N., Valaitis, R. K., Lam, A., Feather, J., Nicholl, J., & Cleghorn, L. (2018). Navigation delivery models and roles of navigators in primary care: a scoping literature review. *BMC health services research*, 18, 1-13.

Chakrabarti, A., Alipoor, A. M., Segaran, T. R. S., Furlanos, S., MacIsaac, R.J., Colman, P.G., & McAuley, S.A. (2022). Exercise habits and glucose management among older adults with type 1 diabetes using insulin pumps. *Acta Diabetologica*, 59, 865-868.

Chan, J. C., Lim, L. L., Luk, A. O., Ozaki, R., Kong, A. P., Ma, R. C., ... & Lo, S. V. (2019). From Hong Kong Diabetes Register to JADE Program to RAMP-DM for data-driven actions. *Diabetes Care*, 42(11), 2022-2031.

Coons, M. J., Greiver, M., Aliarzadeh, B., Meaney, C., Moineddin, R., Williamson, T., ... & Kane, J. J. (2017). Is glycemia control in Canadians with diabetes individualized? A cross-sectional observational study. *BMJ Open Diabetes Research and Care*, 5(1), e000316.

Cp@Clinic. (2023). CP@Clinic. Retrieved May 1, 2023 from <https://cpatclinic.ca/>

Coyne, K. S., Wein, A., Nicholson, S., Kvasz, M., Chen, C. I., & Milsom, I. (2014). Economic burden of urgency urinary incontinence in the United States: a systematic review. *Journal of Managed Care Pharmacy*, 20(2), 130-140.

Crowshoe, L., Dannenbaum, D., Green, M., Henderson, R., Hayward, M. N., & Toth, E. (2018). Type 2 diabetes and Indigenous peoples. *Canadian Journal of Diabetes*, 42, S296-S306.

Datta, G., Siddiqi, A., & Lofters, A. (2021). Transforming race-based health research in Canada. *Canadian Medical Association Journal*, 193(3), E99-E100.

Defeudis, G., Mazzilli, R., Tenuta, M., Rossini, G., Zamponi, V., Olana, S., ... & Gianfrilli, D. (2022). Erectile dysfunction and diabetes: A melting pot of circumstances and treatments. *Diabetes/ Metabolism Research and Reviews*, 38(2), e3494.

de Mestral, C., Gomez, D., Wilton, A. S., Lee, D. S., Albalawi, Z., Austin, P. C., ... & Baxter, N. N. (2022). A population-based analysis of diabetes-related care measures, foot complications, and amputation during the COVID-19 pandemic in Ontario, Canada. *JAMA Network Open*, 5(1), e2142354-e2142354.

Diabetes Action Canada. (2023). About us. Retrieved April 15 from <https://diabetesaction.ca/about-us/>

Diabetes Canada. (2018). Diabetes 360: A Framework for a Diabetes Strategy for Canada. Recommendations for Governments. July 2018. Retrieved Oct. 24, 2022 from <https://www.diabetes.ca/DiabetesCanadaWebsite/media/Advocacy-and-Policy/Diabetes-360-Recommendations.pdf>

Diabetes Canada. (2022a). Diabetes in Canada: 2022 Backgrounder. Retrieved Oct. 4 2022 from https://www.diabetes.ca/DiabetesCanadaWebsite/media/Advocacy-and-Policy/Backgrounder/2022_Backgrounder_Canada_English_1.pdf

Diabetes Canada. (2022b). What is diabetes? Retrieved Oct. 4, 2022 from <https://www.diabetes.ca/about-diabetes/what-is-diabetes>

Diabetes Canada. (2022c). Heart disease and stroke. Retrieved Nov. 22, 2022 from <https://www.diabetes.ca/managing-my-diabetes/preventing-complications/heart-disease---stroke>

Diabetes Canada. (2022d). Amputation Prevention. Retrieved Nov. 22, 2022 from <https://www.diabetes.ca/cmsctx/pv/Denise.Barnard/culture/en-CA/wg/d5bc7acc-aca3-49fbb98b30705e9e63e8/h/0c80faacb3336027c7aabd8bd61631a684820a361efda7a0419ef96cf54720bc/-/advocacy---policies/our-policy-positions/amputation-prevention?u h=1e3d0a6c8aa448171226398930591c5fc88137e5deee64d3223be15d06557075>

Diabetes Canada. (2023a). Personal communication.

Diabetes Canada. (2023b). Diabetes and Diabetes-Related Out-of-Pocket Costs: 2022 Update.

Diabetes Canada. (2023c). Assess your risk of developing diabetes. Retrieved May 1, 2023 from <https://www.diabetes.ca/type-2-risks/risk-factors---assessments>

Diabetes Canada. (2023d). New Brunswick expands coverage for continuous glucose monitors and insulin pumps for people living with diabetes. Retrieved May 29, 2023 from <https://www.diabetes.ca/media-room/news/new-brunswick-expands-coverage-for-continuous-glucose-monitors-and-insulin-pumps-for-people-living-w>

Diabetes Quebec. (2014). Diabetes and Urinary Tract Infections. Retrieved Jan 12, 2023 from <https://www.diabete.qc.ca/en/understand-diabetes/all-about-diabetes/complications/diabetes-and-urinary-tract-infections/>

Dhaliwal, R., & Weinstock, R. S. (2014). Management of type 1 diabetes in older adults. *Diabetes Spectrum*, 27(1), 9-20.

Dickers, M. F., Dunning, T., & Savage, S. (2013). Information needs of family carers of people with diabetes at the end of life: A literature review. *Journal of Palliative Medicine*, 16(12).

Dinca-Panaitescu, S., Dinca-Panaitescu, M., Bryant, T., Daiski, I., Pilkington, B., & Raphael, D. (2011). Diabetes prevalence and income: results of the Canadian Community Health Survey. *Health policy*, 99(2), 116-123.

Dogba, M. J., Dipankui, M. T., Chipenda Dansokho, S., Légaré, F., & Witteman, H. O. (2018). Diabetes-related complications: Which research topics matter to diverse patients and caregivers?. *Health Expectations*, 21(2), 549-559.

- Doss, E. R., & Popejoy, L. L. (2022). Informal Family Caregiving of Patients with Diabetic Extremity Wounds: An Integrative Review. *Western Journal of Nursing Research*, 01939459221115694
- D'Silva, C., Hafleen, N., Mansfield, E., Martel, S., Fierheller, D., Banerjee, A., ... & Zenlea, I. (2022). Service provider perspectives on exploring social determinants of health impacting type 2 diabetes management for South Asian adults in Peel region, Canada. *Canadian Journal of Diabetes*.
- Dunning, T., & Martin, P. (2018). Palliative and end of life care of people with diabetes: Issues, challenges and strategies. *Diabetes Research and Clinical Practice*, 143, 454-463.
- Dunning, T. L. (2020). Palliative and end-of-life care: vital aspects of holistic diabetes care of older people with diabetes. *Diabetes Spectrum*, 33(3), 246-254.
- Edwards, D. (2016). Sexual health and dysfunction in men and women with diabetes. *Diabetes & Primary Care*, 18(6), 288-96.
- Egunsola, O., Dowsett, L. E., Diaz, R., Brent, M. H., Rac, V., & Clement, F. M. (2021). Diabetic retinopathy screening: A systematic review of qualitative literature. *Canadian Journal of Diabetes*, 45(8), 725-733. Doi: 10.1016/j.jcjd.2021.01.014.
- Embil, J., Albalawi, Z., Bowering, K. & Trepman, E. (2018). Foot Care. Diabetes Canada Clinical Practice Guidelines Expert Committee. *Canadian Journal of Diabetes*, s222-s227.
- Felfeli, T., Alon, R., Merritt, R., & Brent, M. H. (2019). Toronto tele-retinal screening program for detection of diabetic retinopathy and macular edema. *Canadian Journal of Ophthalmology*, 54(2), 203-211.
- Felfeli, T., Katsnelson, G., Kiss, A., Plumtre, L., Paterson, J. M., Ballios, B. G., ... & Wong, D. T. (2022). Prevalence and predictors for being unscreened for diabetic retinopathy: a population-based study over a decade. *Canadian Journal of Ophthalmology*.
- Fisher, L., Polonsky, W. H., Hessler, D. M., Masharani, U., Blumer, I., Peters, A. L., ... & Bowyer, V. (2015). Understanding the sources of diabetes distress in adults with type 1 diabetes. *Journal of Diabetes and its Complications*, 29(4), 572-577.
- Flint, K. L., Davis, G. M., & Umpierrez, G. E. (2020). Emerging trends and the clinical impact of food insecurity in patients with diabetes. *Journal of diabetes*, 12(3), 187-196.
- Foster, N., Kapiriri, L., Grignon, M., & McKenzie, K. (2022). "But... I survived": A phenomenological study of the health and wellbeing of aging Black women in the Greater Toronto Area, Canada. *Journal of Women & Aging*, 1-16.
- Gilmour, H. (2018). Formal home care use in Canada. *Health Reports*, 29(9), 3-9.
- Gim, J., & Shah, B. R. (2019). Differences in HbA1C at the time of diabetes diagnosis in the adult population of Ontario, Canada. *Primary Care Diabetes*, 13(4), 310-315.

Government of Canada. (2022). The Impact of COVID-19 on the Wellbeing of Seniors. Reporting on the Standing Committee on Health Resources, Skills and Social Development and the Status of Persons with Disabilities. Retrieved May 12, 2023 from <https://www.ourcommons.ca/Content/Committee/441/HUMA/Reports/RP11867690/humarp03/humarp03-e.pdf>

Government of Canada. (2023a). Canadian Chronic Disease Surveillance System. Retrieved April 15, 2023 from <https://health-infobase.canada.ca/ccdss/data-tool/Age?G=00&V=1&M=5>

Government of Canada. (2023b). Disability Tax Credit. Retrieved April 16, 2023 from <https://www.canada.ca/en/revenue-agency/services/tax/individuals/segments/tax-credits-deductions-persons-disabilities/disability-tax-credit.html>

Government of Canada. (2023c). Medical Expenses 2022. Retrieved April 10, 2023 from <https://www.canada.ca/en/revenue-agency/services/forms-publications/publications/rc4065/medical-expenses.html#toc15>

Government of Canada. (2023d). Line 31285 – Home accessibility expenses. Retrieved April 11, 2023 from <https://www.canada.ca/en/revenue-agency/services/tax/individuals/topics/about-your-tax-return/tax-return/completing-a-tax-return/deductions-credits-expenses/line-31285-home-accessibility-expenses.html>

Government of Canada. (2023e). Canada Caregiver Credit. Retrieved May 26 from <https://www.canada.ca/en/revenue-agency/services/tax/individuals/topics/about-your-tax-return/tax-return/completing-a-tax-return/deductions-credits-expenses/canada-caregiver-amount.html>

Government of Manitoba. (n.d.). Manitoba Adult Insulin Pump Coverage Program. Retrieved May 29, 2023 from <https://www.gov.mb.ca/health/mhsip/maipcp.html>

Government of Manitoba. (2023). Frequently Asked Questions. Expanded Pharmacare Eligibility for Advanced Glucose Monitors (AGM). Retrieved May 29, 2023 from <https://sharedhealthmb.ca/files/agm-expansion-patient-faqs.pdf>

Government of Newfoundland and Labrador. (2023). Budget Speech. Retrieved June 1, 2023 from <https://www.gov.nl.ca/budget/2023/budget-speech/>

Government of Newfoundland and Labrador. (n.d.). The Way Forward: Chronic Disease Action Plan. Retrieved May 1, 2023 from <https://www.gov.nl.ca/hcs/files/chronicdisease-pdf-chronic-illness.pdf>

Government of Ontario. (2022). Coverage for Real-Time Continuous Glucose Monitoring Systems. Retrieved May 29, 2023 from https://www.health.gov.on.ca/en/pro/programs/adp/memos/docs/CGM_QA.pdf

Government of Prince Edward Island. (2023). DASH Program. Retrieved May 11, 2023 from <https://www.princeedwardisland.ca/en/information/health-pei/dash-program>

- Graham, E., Deschênes, S. S., Rosella, L. C., & Schmitz, N. (2021). Measures of depression and incident type 2 diabetes in a community sample. *Annals of Epidemiology*, 55, 4-9.
- Gregory, G. A., Robinson, T. I., Linklater, S. E., Wang, F., Colagiuri, S., de Beaufort, C., ... & Ogle, G. D. (2022). Global incidence, prevalence, and mortality of type 1 diabetes in 2021 with projection to 2040: a modelling study. *The Lancet Diabetes & Endocrinology*, 10(10), 741-760.
- Griffith, L. E., Gruneir, A., Fisher, K., Panjwani, D., Gafni, A., Patterson, C., ... & Ploeg, J. (2019). 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 Services Research*, 19(1), 1-11.
- Gudi, S. K., Bugden, S., Singer, A., & Falk, J. (2022). Potential Over-Treatment and Over-Testing among Older Adults with Type-2 Diabetes across Canada: An Observational Retrospective Cohort Study. *Canadian Journal of Diabetes*.
- Habjan, S., Prince, H., & Kelley, M. L. (2012). Caregiving for elders in first nations communities: social system perspective on barriers and challenges. *Canadian Journal on Aging/La Revue canadienne du vieillissement*, 31(2), 209-222.
- Halseth, R. (2019). The prevalence of Type 2 diabetes among First Nations and considerations for prevention. Prince George, B.C.: National Collaborating Centre for Aboriginal Health.
- Harrison, C., Fortin, M., van den Akker, M., Mair, F., Calderon-Larranaga, A., Boland, F., ... & Smith, S. (2021). Comorbidity versus multimorbidity: Why it matters. *Journal of Multimorbidity and Comorbidity*, 11.
- Heart and Stroke. (2023). Diabetes. Retrieved April 12, 2023 from <https://www.heartandstroke.ca/heart-disease/risk-and-prevention/condition-risk-factors/diabetes>
- Hewston, P., & Deshpande, N. (2018). Fear of falling and balance confidence in older adults with type 2 diabetes mellitus: a scoping review. *Canadian Journal of Diabetes*, 42(6), 664-670.
- Hoban, C., Sareen, J., Henriksen, C. A., Kuzyk, L., Embil, J. M., & Trepman, E. (2015). Mental health issues associated with foot complications of diabetes mellitus. *Foot and ankle surgery*, 21(1), 49-55.
- Hopkins, R., Shaver, K., & Weinstock R.S. (2016). Management of adults with diabetes and cognitive problems. *Diabetes Spectrum*, 29(4), 224-237.
- Hosseini, Z., Whiting, S. J., & Vatanparast, H. (2019). Type 2 diabetes prevalence among Canadian adults—dietary habits and sociodemographic risk factors. *Applied Physiology, Nutrition, and Metabolism*, 44(10), 1099-1104.
- Hubbard, R. E., Andrew, M. K., Fallah, N., & Rockwood, K. (2010). Comparison of the prognostic importance of diagnosed diabetes, co-morbidity and frailty in older people. *Diabetic Medicine*, 27(5), 603-606.

- Idrees, T., Castro-Revoledo, I. A., Migdal, A. L., Moreno, E. M., & Umpierrez, G. E. (2022). Update on the management of diabetes in long-term care facilities. *BMJ Open Diabetes Research and Care*, 10(4), e002705.
- Institute for Clinical Evaluative Sciences. (2003). Diabetes in Ontario: An ICES practice atlas.
- International Federation on Ageing. (2017). The Diabetic Retinopathy Barometer Report: Canada. Retrieved Oct. 25, 2022 from <https://drbarometer.com/wp-content/uploads/2022/08/dr-barometer-survey-canada.pdf>
- International Diabetes Federation. (2022). About World Diabetes Day. Retrieved Oct. 25, 2022 from <http://worlddiabetesday.org/about/>
- International Diabetes Federation. (2023). About Diabetes. Retrieved May 26, 2023 from <https://idf.org/our-activities/care-prevention/cardiovascular-disease.html>
- Institute for HealthCare Improvement. (2020). Age-Friendly Health Systems: Guide to Using the 4Ms in the Care of Older Adults. Retrieved January 12, 2023 from https://www.ihc.org/Engage/Initiatives/Age-Friendly-Health-Systems/Documents/IHIAgeFriendlyHealthSystems_GuidetoUsing4MsCare.pdf
- Jacobson, A. M., Ryan, C. M., Braffett, B. H., Gubitosi-Klug, R. A., Lorenzi, G. M., Luchsinger, J. A., ... & Lachin, J. M. (2021). Cognitive performance declines in older adults with type 1 diabetes: results from 32 years of follow-up in the DCCT and EDIC Study. *The Lancet Diabetes & Endocrinology*, 9(7), 436-445.
- Jacklin, K. M., Henderson, R. I., Green, M. E., Walker, L. M., Calam, B., & Crowshoe, L. J. (2017). Health care experiences of Indigenous people living with type 2 diabetes in Canada. *Canadian Medical Association Journal*, 189(3), E106-E112.
- Jørgensen, M. E., Kristensen, J. K., Reventlov Husted, G., Cerqueira, C., & Rossing, P. (2016). The Danish adult diabetes registry. *Clinical Epidemiology*, 429-434.
- JDRF. (2023a). TD1 Index, unpublished data.
- JDRF. (2023b). Coverage Map. Retrieved May 29, 2023 from <https://www.jdrf.ca/advocacy/access-for-all/coverage-map/>
- Kamenov, Z. A. (2014). A comprehensive review of erectile dysfunction in men with diabetes. *Experimental and Clinical Endocrinology & Diabetes*, 141-158.
- Kastner, M., Cardoso, R., Lai, Y., Treister, V., Hamid, J. S., Hayden, L., Wong, G., Ivers, N. M., Liu, B., Marr, S., Holroyd-Leduc, J., & Straus, S. E. (2018). Effectiveness of interventions for managing multiple high-burden chronic diseases in older adults: a systematic review and meta-analysis. *Canadian Medical Association Journal*, 190, E1004-12. Doi: 10.1503/cmaj.171391.
- Kuluski, K., Gill, A., Naganathan, G., Upshur, R., Jaakkimainen, R. L., & Wodchis, W. P. (2013). A qualitative descriptive study on the alignment of care goals between older persons with multi-morbidities, their family physicians and informal caregivers. *BMC Family Practice*, 14(1), 1-10.
- Lau, D. C., 2016. Diabetes in the elderly: A silent global tsunami. *Canadian Journal of Diabetes*, 40(1), pp.2-3.

- Lefèvre, T., d'Ivernois, J. F., De Andrade, V., Crozet, C., Lombrail, P., & Gagnayre, R. (2014). What do we mean by multimorbidity? An analysis of the literature on multimorbidity measures, associated factors, and impact on health services organization. *Revue d'épidémiologie et de sante publique*, 62(5), 305-314.
- Lega, I. C., Kapur, A., Leung, F., & Zahedi, A. (2020). Type 2 diabetes in older adults in long-term care homes: an educational intervention to improve diabetes care. *Canadian Journal of Diabetes*, 44(5), 407-413.
- Lega, I. C., Campitelli, M. A., Austin, P. C., Na, Y., Zahedi, A., Leung, F., Yu, C., Bronskill, S. E., Rochon, P. A., & Lipscombe, L. L. (2021). Potential diabetes overtreatment and risk of adverse events among older adults in Ontario: A population-based study. *Diabetologia*, 64(5), 1093-1102.
- Leiter, L. A., Berard, L., Bowering, C. K., Cheng, A. Y., Dawson, K. G., Ekoé, J. M., ... & Langer, A. (2013). Type 2 diabetes mellitus management in Canada: is it improving?. *Canadian Journal of Diabetes*, 37(2), 82-89.
- Leroux, J., Morrison, K., & Rosenberg, M. (2018). Prevalence and predictors of food insecurity among older people in Canada. *International Journal of Environmental Research and Public Health*, 15(11), 2511.
- Leung, E., Wongrakpanich, S., & Munshi, M. N. (2018). Diabetes management in the elderly. *Diabetes Spectrum: a Publication of the American Diabetes Association*, 31(3), 245.
- Lewis, E. J., Lovblom, L. E., Lanctot, S., Scarr, D., Cardinez, N., Boulet, G., ... & Perkins, B. A. (2022). The association between physical activity time and neuropathy in longstanding type 1 diabetes: A cross-sectional analysis of the Canadian study of longevity in type 1 diabetes. *Journal of Diabetes and its Complications*, 36(3), 108134.
- Lipscombe, C., Burns, R. J., & Schmitz, N. (2015). Exploring trajectories of diabetes distress in adults with type 2 diabetes; a latent class growth modeling approach. *Journal of Affective Disorders*, 188, 160-166.
- Lipska, K. J., Ross, J. S., Miao, Y., Shah, N. D., Lee, S. J., & Steinman, M. A. (2015). Potential overtreatment of diabetes mellitus in older adults with tight glycemic control. *JAMA internal medicine*, 175(3), 356-362.
- Lovshin, J. A., Bjornstad, P., Lovblom, L. E., Bai, J. W., Lytvyn, Y., Boulet, G., ... & Cherney, D. Z. (2018). Atherosclerosis and microvascular complications: results from the Canadian study of longevity in type 1 diabetes. *Diabetes Care*, 41(12), 2570-2578.
- Lovshin, J. A., Lytvyn, Y., Lovblom, L. E., Katz, A., Boulet, G., Bjornstad, P., ... & Cherney, D. Z. (2019). Retinopathy and RAAS activation: results from the Canadian study of longevity in type 1 diabetes. *Diabetes Care*, 42(2), 273-280.
- Lukewich, J., Buote, R., Asghari, S., Aubrey-Bassler, K., Knight, J., & Mathews, M. (2020). Adults with diabetes mellitus in Newfoundland and Labrador: a population-based, cross-sectional analysis. *Canadian Medical Association Open Access Journal*, 8(4), E895-E901.

- MacDonald, B.-J., Wolfson, M., & Hirdes, J. P. (2019). The future co\$ of long-term care in Canada. National Institute on Ageing.
- MacKenzie, H. T., Tugwell, B., Rockwood, K., & Theou, O. (2020). Frailty and diabetes in older hospitalized adults: the case for routine frailty assessment. *Canadian Journal of Diabetes*, 44(3), 241-245.
- Magliano, D. J., Chen, L., Carstensen, B., Gregg, E. W., Pavkov, M. E., Salim, A., ... & Shaw, J. E. (2022). Trends in all-cause mortality among people with diagnosed diabetes in high-income settings: a multicountry analysis of aggregate data. *The Lancet Diabetes & Endocrinology*, 10(2), 112-119.
- Mannucci, E., Monami, M., Dicembrini, I., Piselli, A., & Porta, M. (2014). Achieving HbA1c targets in clinical trials and in the real world: a systematic review and meta-analysis. *Journal of endocrinological investigation*, 37, 477-495.
- Manuel, D. G., Tuna, M., Hennessy, D., Bennett, C., Okhmatovskaia, A., Finès, P., ... & Canadian Cardiovascular Outcome Research Team. (2014). Projections of preventable risks for cardiovascular disease in Canada to 2021: a microsimulation modelling approach. *Canadian Medical Association Open Access Journal*, 2(2), E94-E101.
- Markle-Reid, M., Ploeg, J., Fraser, K.D., Fisher, K.A., Bartholomew, A., Griffith, L.E., Miklavic, J., Gafni, A., Thabane, L., & Upshur, R. (2018). Community Program Improves Quality of Life and Self-Management in Older Adults with Diabetes Mellitus and Comorbidity. *Journal of the American Geriatric Society*, 66(2), 263-273. Doi: 10.1111/jgs.15173.
- Markle-Reid, M., McAiney, C., Fisher, K., Ganann, R., Gauthier, A. P., Heald-Taylor, G., ... & Whitmore, C. (2021). Effectiveness of a nurse-led hospital-to-home transitional care intervention for older adults with multimorbidity and depressive symptoms: A pragmatic randomized controlled trial. *Plos one*, 16(7), e0254573.
- Matthew-Maich, N., Harris, L., Ploeg, J., Markle-Reid, M., Valaitis, R., Ibrahim, S., ... & Isaacs, S. (2016). Designing, implementing, and evaluating mobile health technologies for managing chronic conditions in older adults: a scoping review. *JMIR mHealth and uHealth*, 4(2), e5127.
- McAiney, C., Markle-Reid, M., Ganann, R., Whitmore, C., Valaitis, R., Urajnik, D. J., ... & McElhaney, J. E. (2022). Implementation of the Community Assets Supporting Transitions (CAST) transitional care intervention for older adults with multimorbidity and depressive symptoms: A qualitative descriptive study. *Plos One*, 17(8), e0271500.
- McAuley, S. A., Trawley, S., Vogrin, S., Ward, G. M., Furlanos, S., Grills, C. A., ... & MacIsaac, R. J. (2022). Closed-loop insulin delivery versus sensor-augmented pump therapy in older adults with type 1 diabetes (ORACL): a randomized, crossover trial. *Diabetes Care*, 45(2), 381-390.
- McCracken, R., McCormack, J., McGregor, M. J., Wong, S. T., & Garrison, S. (2017). Associations between polypharmacy and treatment intensity for hypertension and diabetes: a cross-sectional study of nursing home patients in British Columbia, Canada. *BMJ Open*, 7(8), e017430.

McGilton, K. S., Vellani, S., Yeung, L., Chishtie, J., Commisso, E., Ploeg, J., Andrew, M. K., Ayala, A. P., Gray, M., Morgan, D., Chow, A. F., Parrott, E., Stephens, D., Hale, L., Keatings, M., Walker, J., Wodchis, W. P., Dubé, V., McElhane, J., & Puts, M. (2018). Identifying and understanding the health and social care needs of older adults with multiple chronic conditions and their caregivers: A scoping review. *BMC Geriatrics, 18*(1), 231.

Medvedyuk, S., Ali, A., & Raphael, D. (2018). Ideology, obesity and the social determinants of health: a critical analysis of the obesity and health relationship. *Critical Public Health, 28*(5), 573-585.

Meeking, D. R., Fosbury, J. A., & Cummings, M. H. (2013). Sexual dysfunction and sexual health concerns in women with diabetes. *Practical Diabetes, 30*(8), 327-331a.

Meneilly, G. S., & Tessier, D. M. (2016). Diabetes, dementia and hypoglycemia. *Canadian Journal of Diabetes, 40*(1), 73-76.

Meneilly, G. S., Berard, L. D., Cheng, A. Y. Y., Lin, P. J., MacCallum, L., Tsuyuki, R. T., Yale, J., Nasser, N., Richard, J., Goldin, L., Langer, A., Tan, M. K., & Leiter, L. A. (2018). Insights into the current management of older adults with type 2 diabetes in the Ontario primary care setting. *Canadian Journal of Diabetes, 42*, 23-30.

Meneilly, G. S., Knip, A., Miller, D. B., Sherifali, D., Tessier, D., & Zahedi, A. (2018). Diabetes in older people. *Canadian Journal of Diabetes, 42*, S283-S295.

Milson, I. (2017). Epidemiology of urinary incontinence and other lower urinary tract symptoms, pelvic organ prolapse and anal incontinence. *Incontinence. International Continence Society, 1*-142.

Miller, K. M., Kanapka, L. G., Rickels, M. R., Ahmann, A. J., Aleppo, G., Ang, L., ... & WISDM Study Group. (2022). Benefit of continuous glucose monitoring in reducing hypoglycemia is sustained through 12 months of use among older adults with type 1 diabetes. *Diabetes technology & therapeutics, 24*(6), 424-434.

Mojdani, D., Mitchell, B. D., Spaepen, E., Syring, K., Rabasa-Lhoret, R., Punthakee, Z., ... & Peyrot, M. (2020). Conversations and Reactions Around Severe Hypoglycemia Study: Results of Canadian Adults With Insulin Treated Diabetes and Caregivers. *Canadian Journal of Diabetes.*

Moin, J. S., Troke, N., Plumpre, L., & Anderson, G. M. (2022). The Impact of the COVID-19 Pandemic on Diabetes Care for Adults with Type 2 Diabetes in Ontario, Canada. *Canadian Journal of Diabetes.*

Moody, L., Wood, E., Needham, A., Booth, A., Jimenez-Aranda, A., & Tindale, W. (2022). Identifying individual enablers and barriers to the use of digital technology for the self-management of long-term conditions by older adults. *Journal of Medical Engineering & Technology, 46*(6), 448-461.

Munshi, M. N., Florez, H., Huang, E. S., Kalyani, R. R., Mupanomunda, M., Pandya, N., ... & Haas, L. B. (2016). Management of diabetes in long-term care and skilled nursing facilities: a position statement of the American Diabetes Association. *Diabetes care, 39*(2), 308-318.

- Munshi, M. N., Meneilly, G. S., Rodríguez-Mañas, L., Close, K. L., Conlin, P. R., Cukierman-Yaffe, T., ... & Sinclair, A. J. (2020). Diabetes in ageing: pathways for developing the evidence base for clinical guidance. *The Lancet Diabetes & Endocrinology*, 8(10), 855-867.
- Munshi, M. N., Sy, S. L., Florez, H. J., Huang, E. S., Lipska, K. J., Myrka, A., ... & Triller, D. M. (2022). Defining Minimum Necessary Communication During Care Transitions for Patients on Antihyperglycemic Medication: Consensus of the Care Transitions Task Force of the IPRO Hypoglycemia Coalition. *Diabetes Therapy*, 13(3), 535-549.
- Murray, C. M., & Shah, B. R. (2016). Diabetes self-management education improves medication utilization and retinopathy screening in the elderly. *Primary care diabetes*, 10(3), 179-185.
- National Health Service. (2023). National Diabetes Foot Care Audit. Retrieved April 12, 2023 from <https://digital.nhs.uk/data-and-information/clinical-audits-and-registries/national-diabetes-foot-care-audit>
- National Diabetes Registry. (n.d.). About NDR. Retrieved April 12, 2023 from <https://www.ndr.nu/#/english>
- National Indigenous Diabetes Association. (2023). Indigenous Engagement on a National Diabetes framework. Retrieved June 5, 2023 from <https://nada.ca/indigenous-engagement-on-a-national-diabetes-framework/>
- National Institute on Ageing. (2020). An Evidence Informed National Seniors Strategy for Canada - Third Edition. Toronto, ON: National Institute on Ageing.
- National Institute on Ageing. (2022). Ageing in the Right Place: Supporting Older Canadians to Live Where They Want. Toronto, ON: National Institute on Ageing
- National Institute on Ageing. (2018). We Can't Address What We Don't Measure Consistently: Building Consensus on Frailty in Canada. Toronto, ON: National Institute on Ageing.
- Northwood, M., Ploeg, J., Markle-Reid, M., & Sherifali, D. (2018). Integrative review of the social determinants of health in older adults with multimorbidity. *Journal of Advanced Nursing*, 74(1), 45-60.
- Northwood, M., Markle-Reid, M., Sherifali, D., Fisher, K., & Ploeg, J. (2021a). Cross-sectional Study of Prevalence and Correlates of Urinary Incontinence in Older Home-Care Clients With Type 2 Diabetes in Ontario, Canada. *Canadian Journal of Diabetes*, 45(1), 47-54.
- Northwood, M., Ploeg, J., Markle-Reid, M., & Sherifali, D. (2021b). Home-care nurses' experiences of caring for older adults with type 2 diabetes mellitus and urinary incontinence: An interpretive description study. *SAGE open nursing*, 7.
- Northwood, M., Ploeg, J., Markle-Reid, M., & Sherifali, D. (2021c). The Complexity of Living with Diabetes and Urinary Incontinence for Older Adults with Multiple Chronic Conditions Receiving Home Care Services: An Interpretive Description Study. *Global Qualitative Nursing Research*, 8.
- Northwood, M., Shah, A. Q., Abeygunawardena, C., Garnett, A., & Schumacher, C. (2023). Care Coordination of Older Adults With Diabetes: A Scoping Review. *Canadian Journal of Diabetes*, 47(3), 272-286.

Nova Scotia Health Authority. (2019). The Diabetes Guidelines for Elderly Residents in LTC Facilities, Diabetes Care Program of Nova Scotia. Retrieved March 12, 2023 from <https://physicians.nshealth.ca/topics/primary-health-care/supporting-patients-manage-chronic-conditions/supporting-patients-4>

Nova Scotia Health. (n.d.). Diabetes Care Program of Nova Scotia. Retrieved May 12, 2023 from <https://physicians.nshealth.ca/topics/primary-health-care/supporting-patients-manage-chronic-conditions/supporting-patients-living>

Nguyen, M., Stamenova, V., Onabajo, N., Merritt, R., Sutakovic, O., Mossman, K., ... & Bhattacharyya, O. (2022). Perceptions of a teleophthalmology screening program for diabetic retinopathy in adults with type 1 and type 2 diabetes in urban primary care settings. *Canadian Journal of Diabetes*, 46(7), 649-654.

Ogunwole, S. M., & Golden, S. H. (2021). Social determinants of health and structural inequities—root causes of diabetes disparities. *Diabetes Care*, 44(1), 11-13.

Ontario Telemedicine Network. (2023). Teleophthalmology. Retrieved March 31, 2023 from <https://otn.ca/patients/ophthalmology/>

Osman, O., Sherifali, D., Stolee, P., & Heckman, G. (2016). Diabetes management in long-term care: an exploratory study of the current practices and processes to managing frail elderly persons with type 2 diabetes. *Canadian Journal of Diabetes*, 40(1), 17-30.

Patel, J., Zamzam, A., Syed, M., Blanchette, V., Cross, K., Albalawi, Z., Al-Omran, M., & de Mestral, C. (2022). A scoping review of foot screening in adults with diabetes mellitus across Canada. *Canadian Journal of Diabetes*, 46(5), 435-440.e2.

Perkins, B. A., Lovblom, L. E., Lanctôt, S. O., Lamb, K., & Cherney, D. Z. (2021). Discoveries from the study of longstanding type 1 diabetes. *Diabetologia*, 64, 1189-1200.

Ploeg, J., Matthew-Maich, N., Fraser, K., Dufour, S., McAiney, C., Kaasalainen, S., Markle-Reid, M., Upshur, R., Cleghorn, L., & Emili, A. (2017a). Managing multiple chronic conditions in the community: a Canadian qualitative study of the experiences of older adults, family caregivers and healthcare providers. *BMC Geriatrics*, 17, 40.

Ploeg, J., Markle-Reid, M., Valaitis, R., McAiney, C., Duggleby, W., Bartholomew, A., & Sherifali, D. (2017b). Web-Based Interventions to Improve Mental Health, General Caregiving Outcomes, and General Health for Informal Caregivers of Adults With Chronic Conditions Living in the Community: Rapid Evidence Review. *Journal of Medical Internet Research*, 19(7), e7564.

Ploeg, J., Canesi, M., Fraser, K. D., McAiney, C., Kaasalainen, S., Markle-Reid, M., ... & Chambers, T. (2019). Experiences of community-dwelling older adults living with multiple chronic conditions: a qualitative study. *BMJ open*, 9(3), e023345.

- Ploeg, J., Markle-Reid, M., Valaitis, R., Fisher, K., Ganann, R., Blais, J., ... & Yous, M. L. (2022). The Aging, Community and Health Research Unit Community Partnership Program (ACHRU-CPP) for older adults with diabetes and multiple chronic conditions: study protocol for a randomized controlled trial. *BMC Geriatrics*, 22(1), 1-22.
- Pirrie, M., Harrison, L., Angeles, R., Marzanek, F., Ziesmann, A., & Agarwal, G. (2020). Poverty and food insecurity of older adults living in social housing in Ontario: a cross-sectional study. *BMC Public Health*, 20(1), 1-10.
- Ploeg, J., Northwood, M., Duggleby, W., McAiney, C. A., Chambers, T., Peacock, S., Fisher, K., Ghosh, S., Markle-Reid, M., Swindle, J., Williams, A., & Triscott, J. A. (2020). Caregivers of older adults with dementia and multiple chronic conditions: Exploring their experiences with significant changes. *Dementia (London)*, 19(8), 2601-2620.
- Prinjha, S., Wicklow, B., Nakhla, M., & Banerjee, A. T. (2022). Toward the Goal of Understanding and Tackling the Social Determinants of Diabetes. *Canadian Journal of Diabetes*, 46(6), 549-550.
- Public Health Agency of Canada. (2009). Report from the National Diabetes Surveillance System: Diabetes in Canada, 2009. Retrieved Nov. 23, 2022 from <https://www.canada.ca/content/dam/phac-aspc/migration/phac-aspc/publicat/2009/ndssdic-snsddac-09/pdf/report-2009-eng.pdf>
- Public Health Agency of Canada. (2017a). Diabetes in Canada: Highlights from the Canadian Chronic Disease Surveillance System. Retrieved Oct. 4 2,022 from <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/diabetes-canada-highlights-chronic-disease-surveillance-system/diabetes-in-canada-eng.pdf>
- Public Health Agency of Canada. (2017b). The Canadian diabetes risk questionnaire: CANRISK. Retrieved Oct. 24, 2022 from <https://www.healthycanadians.gc.ca/en/canrisk>
- Public Health Agency of Canada. (2022a). A Framework for Diabetes in Canada. Government of Canada. Retrieved Nov. 10, 2022 from <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/diseases-conditions/framework-diabetes-canada/framework-diabetes-canada.pdf>
- Public Health Agency of Canada. (2022b). Impact of COVID-19 in adults with chronic conditions: Emergency department visits. Retrieved Nov. 10, 2022 from factsheet. pdf (canada.ca)
- Punthakee, Z., Goldenberg, R., & Katz, P. (2018). Definition, classification and diagnosis of diabetes, prediabetes and metabolic syndrome. *Canadian journal of diabetes*, 42, S10-S15.
- Ramtoola, S., Nyeland, M. E., Jacobsen, J., Ploug, U. J., Kragh, N., & Zimmermann, E. (2020). Characteristics of newly diagnosed adults with type 1 diabetes in the UK and evolution of glycaemic control, body mass index and Charlson comorbidity index over the first 5 years after diagnosis. *Primary Care Diabetes*, 14(4), 349-355.

Remelli, F., Ceresini, M. G., Trevisan, C., Noale, M., & Volpato, S. (2022). Prevalence and impact of polypharmacy in older patients with type 2 diabetes. *Aging Clinical and Experimental Research*, 1-15.

Robinson, D. J., Coons, M., Haensel, H., Vallis, M., & Yale, J. F. (2018). Diabetes and mental health. *Canadian Journal of Diabetes*, 42, S130-S141.

Sanders, A., & Stone, R. (2011). Supporting aging in place in subsidized housing: an evaluation of the well elder program. *Washington, DC: LeadingAge Center for Applied Research*.

Sarodnik, C., Bours, S. P. G., Schaper, N. C., Van den Bergh, J. P., & Van Geel, T. A. C. M. (2018). The risks of sarcopenia, falls and fractures in patients with type 2 diabetes mellitus. *Maturitas*, 109, 70-77.

Saskatchewan Health Authority. (2014). Diabetes Foot Care Clinical Practice Guidelines. Retrieved March 12, 2023 from https://www.saskatoonhealthregion.ca/locations_services/Services/cdm/Pages/Programs/Diabetes-Foot-Care-Clinical-Practise-Guidelines.aspx

Savage, S., Duggan, N., Dunning, T., & Martin, P. (2012). The experiences and care preferences of people with diabetes at the end of life. *Journal of Hospice & Palliative Nursing*, 14(4), 293-302. Doi: 10.1097/NJH.0b013e31824bdb39.

Shah, V. N., Wu, M., Foster, N., Dhaliwal, R., & Al Mukaddam, M. (2018). Severe hypoglycemia is associated with high risk for falls in adults with type 1 diabetes. *Archives of Osteoporosis*, 13, 66.

Shah, B. R., Lipscombe, L. L., & Booth, G. L. (2021). Glycemic Control Among People With Diabetes in Ontario: A Population-Based Cross-Sectional Study. *Canadian Journal of Diabetes*, 45(4), 313-318.

Sharma, A., Sikora, L., & Bush, S. H. (2019). Management of diabetes mellitus in adults at the end of life: a review of recent literature and guidelines. *Journal of Palliative Medicine*, 22(9), 1133-1138.

Shaw, C., Wagg, A., & Cahill, J. J. (2020). The current state of continence in Canada: A population representative epidemiological survey. *Canadian Journal of Urology*, 27(4), 10300-1030

Sherifali, D., Bai, J. W., Kenny, M., Warren, R., & Ali, M. U. (2015). Diabetes self-management programmes in older adults: a systematic review and meta-analysis. *Diabetic Medicine*, 32(11), 1404-1414.

Sherifali, D., & Meneilly, G. (2016). Diabetes management and education in older adults: the development of a national consensus of key research priorities. *Canadian journal of diabetes*, 40(1), 31-34.

Sherifali, D., Ali, M. U., Ploeg, J., Markle-Reid, M., Valaitis, R., Bartholomew, A., ... & McAiney, C. (2018). Impact of internet-based interventions on caregiver mental health: systematic review and meta-analysis. *Journal of Medical Internet Research*, 20(7), e10668.

Sidhu, R., & Tang, T. S. (2017). Diabetes distress and depression in South Asian Canadians with type 2 diabetes. *Canadian Journal of Diabetes*, 41(1), 69-72.

Sinclair, A. J., Abdelhafiz, A. H., Forbes, A., & Munshi, M. (2019). Evidence-based diabetes care for older people with type 2 diabetes: a critical review. *Diabetic Medicine*, 36(4), 399-413.

Sinclair, A. J., Girling, A. J., & Bayer, A. J. (2000). Cognitive dysfunction in older subjects with diabetes mellitus: impact on diabetes self-management and use of care services. *Diabetes Research and Clinical Practice*, 50, 203-212.

Sinclair, A., Dunning, T., & Rodriguez-Manas, L. (2015). Diabetes in older people: new insights and remaining challenges. *Lancet Diabetes & Endocrinology*, 3(4), 275-85.

Sinclair, A. J., Gadsby, R., Abdelhafiz, A. H., & Kennedy, M. (2018). Failing to meet the needs of generations of care home residents with diabetes: a review of the literature and a call for action. *Diabetic Medicine*, 35(9), 1144-1156.

South Riverdale Community Health Centre. (2022). Diabetes Eye Screening Program-Teleophthalmology. Retrieved Nov. 24, 2022 from <https://www.srchc.ca/programs/healthcare/teleophthalmology-program-2/>

Skinner, T. C., Joensen, L., & Parkin, T. (2020). Twenty-five years of diabetes distress research. *Diabetic Medicine*, 37(3), 393-400.

Stasinopoulos, J., Wood, S. J., Bell, J. S., Manski-Nankervis, J. A., Hogan, M., & Sluggett, J. K. (2021). Potential overtreatment and undertreatment of type 2 diabetes mellitus in long-term care facilities: a systematic review. *Journal of the American Medical Directors Association*, 22(9), 1889-1897.

Statistics Canada. (2020). Primary health care providers, 2019. Retrieved Oct. 24, 2022 from <https://www150.statcan.gc.ca/n1/pub/82-625-x/2020001/article/00004-eng.htm>

Statistics Canada. (2021). Chronic conditions among seniors aged 65 and older, Canadian Health Survey on Seniors. Retrieved April 12, 2023 from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310078801>

Statistics Canada. (2022a). The daily: In the midst of high job vacancies and historically low unemployment, Canada faces record retirements from an aging labour force: number of seniors aged 65 and older grows six times faster than children 0-14. Retrieved Nov. 23, 2022 <https://www150.statcan.gc.ca/n1/daily-quotidien/220427/dq220427a-eng.htm>

Statistics Canada. (2022b). A portrait of Canada's growing population aged 85 and older from the 2021 Census. Retrieved May 1, 2023 from <https://www12.statcan.gc.ca/census-recensement/2021/as-sa/98-200-X/2021004/98-200-x2021004-eng.cfm>

Statistics Canada. (2022c). Leading causes of death, total population, by age group. Retrieved May 20, 2023 from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310039401>

Statistics Canada. (2022d). Diabetes, by age group. Released 2022-08-26. Retrieved Oct. 4, 2022 from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310009607>

Statistics Canada. (2022e). Chronic conditions among seniors aged 65 years and older, Canadian Health Survey on Seniors, two-year period estimates. Retrieved Nov. 23, 2022 from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310084901>

Steffler, M., Li, Y., Weir, S., Shaikh, S., Murtada, F., Wright, J. G., & Kantarevic, J. (2021). Trends in prevalence of chronic disease and multimorbidity in Ontario, Canada. *Canadian Medical Association Journal*, 193(8), E270-E277.

Stone, J., Houlden, R., Lin, P., Udell, J. & Verma, S. (2018). Cardiovascular Protection in People with Diabetes. Diabetes Canada Clinical Practice Guidelines Expert Committee. *Canadian Journal of Diabetes*, s162-s169.

Tan, C. C. L., Cheng, K. K. F., & Wang, W. (2015). Self-care management programme for older adults with diabetes: An integrative literature review. *International Journal of Nursing Practice*, 21, 115-124.

T1D Exchange. (2023). The T1D Exchange. Retrieved May 29, 2023 from <https://t1dexchange.org/registry/>

Toschi, E., & Munshi, M. N. (2020). Benefits and challenges of diabetes technology use in older adults. *Endocrinology and Metabolism Clinics of North America*, 49(1), 57-67. Doi: 10.1016/j.ecl.2019.10.001.

Tremblay, M. C., Graham, J., Porgo, T. V., Dogba, M. J., Paquette, J. S., Careau, E., & Witteman, H. O. (2020). Improving cultural safety of diabetes care in Indigenous populations of Canada, Australia, New Zealand and the United States: a systematic rapid review. *Canadian Journal of Diabetes*, 44(7), 670-678.

Tremblay, M. C., Bradette-Laplante, M., Witteman, H. O., Dogba, M. J., Breault, P., Paquette, J. S., ... & Echaquan, S. (2021). Providing culturally safe care to Indigenous people living with diabetes: Identifying barriers and enablers from different perspectives. *Health Expectations*, 24(2), 296-306.

T1D Index. (2023). Canada Dashboard. Retrieved May 26, 2023 from https://t1dindex.shinyapps.io/dashboard/?loc_id=124&_ga=2.12034164.1360921007.1685130191-1051331403.1685130191

van Allen, Z., Dogba, M. J., Brent, M. H., Bach, C., Grimshaw, J. M., Ivers, N. M., ... & Presseau, J. (2021). Barriers to and enablers of attendance at diabetic retinopathy screening experienced by immigrants to Canada from multiple cultural and linguistic minority groups. *Diabetic Medicine*, 38(4), e14429.

Valaitis, R., Cleghorn, L., Ploeg, J., Risdon, C., Mangin, D., Dolovich, L., ... & Chung, H. (2020). Disconnected relationships between primary care and community-based health and social services and system navigation for older adults: a qualitative descriptive study. *BMC Family Practice*, 21(1), 1-11.

Vallis, M., Burns, K. K., Hollahan, D., Ross, S., & Hahn, J. (2016). Diabetes attitudes, wishes and needs second study (DAWN2): understanding diabetes-related psychosocial outcomes for Canadians with diabetes. *Canadian Journal of Diabetes*, 40(3), 234-241.

- Vincent, C., Hall, P., Ebsary, S., Hannay, S., Hayes-Cardinal, L., & Husein, N. (2016). Knowledge confidence and desire for further diabetes-management education among nurses and personal support workers in long-term care. *Canadian Journal of Diabetes*, 40(3), 226-233.
- Wagg, A., Chen, L. K., Johnson II, T., Kirschner-Hermanns, R., Kuchel, G., Markland, A., Murphy, C., Orme, S., Ostaszkiwicz, J., Szonyi, G., & Wyman, J. (2017). Incontinence in Frail Older Persons. In P. Abrams, L. Cardozo, A. Wagg, & A. Wein (Eds.), *Incontinence 6th Edition* (2017) (6th ed.). International Continence Society.
- Walker, R. J., Garacci, E., Palatnik, A., Ozieh, M. N., & Egede, L. E. (2020). The longitudinal influence of social determinants of health on glycemic control in elderly adults with diabetes. *Diabetes Care*, 43(4), 759-766.
- Washington, K. T., Meadows, S. E., Elliott, S. G., & Koopman. (2011). Information needs of informal caregivers of older adults with chronic health conditions. *Patient Education and Counseling*, 83(1), 37-44.
- Whitehouse, C. R., Long, J. A., Maloney, L. M., Daniels, K., Horowitz, D. A., & Bowles, K. H. (2020). Feasibility of diabetes self-management telehealth education for older adults during transitions in care. *Research in Gerontological Nursing*, 13(3). Doi: 10.3928/19404921-20191210-03.
- Winkley, K., Kristensen, C., & Fosbury, J. (2021). Sexual health and function in women with diabetes. *Diabetic Medicine*, 38(11), e14644.
- Wister, A., & Speechley, M. (2020). COVID-19: pandemic risk, resilience and possibilities for aging research. *Canadian Journal on Aging/La revue Canadienne du Vieillissement*, 39(3), 344-347.
- Wong, E. M., Afshar, R., Qian, H., Zhang, M., Elliott, T. G., & Tang, T. S. (2017). Diabetes distress, depression and glycemic control in a Canadian-based specialty care setting. *Canadian Journal of Diabetes*, 41(4), 362-365.
- Yang, Y., Hu, X., Zhang, Q., & Zou, R. (2016). Diabetes mellitus and risk of falls in older adults: a systematic review and meta-analysis. *Age and Ageing*, 45(6), 761-767.
- Yedidia, M. J., & Tiedemann, A. (2008). How Do Family Caregivers Describe Their Needs For Professional Help? *Journal of Social Work Education*, 44(sup3), 43-47.
- Yu, C., Choi, D., Bruno, B. A., Thorpe, K. E., Straus, S. E., Cantarutti, P., Chu, K., Frydrych, P., Hoang-Kim, A., Ivers, N., Kaplan, D., Leung, F-H., Maxted, J., Rezmovitz, J., Sale, J., Sodhi-Helou, S., Stacey, D., & Telnet, D. (2020). Impact of MyDiabetesPlan, a Web-Based Patient Decision Aid on Decisional Conflict, Diabetes Distress, Quality of Life, and Chronic Illness Care in Patients with Diabetes: Cluster Randomized Controlled Trial. *Journal of Medical Internet Research*, 22(9), e16984.

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