

Reversing the Course of Type 2 Diabetes:

ENVIRONMENTAL SCAN

January 2020



**Institute for
Health System**
Transformation
& Sustainability

Preface:

This document was prepared to support a Dialogue, held in Vancouver Canada on June 17th, 2019.

About IHSTS: The Institute for Health System Transformation and Sustainability is a not-for-profit, independent organization. With partners, IHSTS aims to strengthen the sustainability of BC's health and care system through effective enquiry processes that ignite insights and generate practical solutions. More about IHSTS can be found here: www.ihsts.ca

Table of Contents

Preface:	1
BACKGROUND AND OBJECTIVES	3
Background	3
Objectives	3
METHODOLOGY	3
Scope	3
Assumptions	4
Data Collection.....	4
Limitations	4
CONTEXT – DIABETES IN BRITISH COLUMBIA	5
Defining Diabetes.....	5
Incidence and Prevalence	5
Diabetes and the Social Determinants of Health	8
Impact of Diabetes on Individuals and Society	9
SCAN RESULTS	11
Strategy and Policy	11
British Columbia.....	11
Other Provinces	12
National	12
International	13
Individual and Population Interventions	14
Individual Interventions	14
Population Interventions	17
Programs and Organizations	19
Prevention	19

Management.....	19
Research	20
DISCUSSION	21
APPENDICES	22
Appendix 1: Strategic overview of diabetes system at provincial and federal level.....	22
Appendix 2: Kelowna diabetes prevention and management community profile	24

BACKGROUND AND OBJECTIVES

Background

Type 2 diabetes is a largely preventable chronic illness resulting in poor health outcomes for individuals and substantial costs to the health system. While there is important work being done across many sectors in British Columbia to meet the challenge of increasing prevalence, there are opportunities for enhanced collaboration, systematic sharing of knowledge, and acceleration of leading practices in the prevention, management and reversal type 2 diabetes.

This Environmental Scan was undertaken as a step towards supporting conversation and collaboration amongst clinicians, researchers, policy makers, population health experts, patients and educators to better enable system-level change.

Objectives

The primary objective of this scan was to identify and document clinical practices, policies, guidelines and research in the area of type 2 diabetes. A secondary objective was to identify emerging innovations which may have promise to change the trend of increasing type 2 diabetes prevalence.

The scan provides a snapshot of the current status of type 2 diabetes prevention and management in terms of the following overlapping areas:

- Strategy and policy
- Clinical interventions
- Population interventions
- Organizations and programs

METHODOLOGY

Scope

The scan was scoped to capture:

- Programs and research focused on type 2 diabetes.

- Programs and research focused on prevention, management or reversal, or any combination of the three.
- Programs and research, with a focus on:
 - Programs that have been rigorously evaluated
 - "Landmark" work
 - Local and recent work
 - Reports and publications written in English
- Programs and research in the realm of the health system, or targeting specific health outcomes

Assumptions

It was assumed a very broad range of factors interact and cause type 2 diabetes in individuals. The scientific evidence supporting a deep understanding of these factors is still emerging and far from complete. For this scan, medical and non-medical determinants of an individual's health status were included.

Much of the work in chronic disease prevention focuses on underlying risk factors rather than specific diseases or conditions. As a result, much of the relevant published research is often not specifically tied to type 2 diabetes. In order to capture this relevant work, it was assumed the following interventions contribute positively to addressing the type 2 diabetes:

- Population or individual Interventions that successfully induce weight loss
- Population or individual Interventions that successfully encourage healthier diets, including consumption of fewer calories or consumption of more fruits and vegetables
- Population or individual Interventions that successfully promote an increase in physical activity

Data Collection

Information collected and reviewed for this scan includes project summaries, best practices, evidence for effectiveness and evidence for cost-effectiveness. In developing the scan, we analysed over 200 publications and organizations.

Limitations

While an effort has been made to ensure that the review was comprehensive and reflective of the current type 2 diabetes environment, there are thousands of published reports and articles related to type 2 diabetes and as a result many some have not been included in the analysis. A mix of internet searches and expert recommendations were used to source and curate the material.

CONTEXT – DIABETES IN BRITISH COLUMBIA

Defining Diabetes

Most cases of diabetes are either type 1 diabetes or type 2 diabetes. Type 1 diabetes is a disease in which cells in the pancreas produce little or no insulin. While the causes are not fully understood, there is a genetic component with type 1 diabetes and there are no known major modifiable risk factors. Type 2 diabetes occurs when the pancreas does not make insulin well and/or when insulin has become less effective at controlling glucose in the blood. Type 2 diabetes usually develops over time, with weight, age and inactivity being the most common risk factors. Other risk factors include family history, ethnicity, diet composition and depression.¹

While this scan is focused on type 2 diabetes, most of the statistics available in BC and Canada include both type 1 and type 2 diabetes. The combined statistics can still provide valuable information as over 90% of Canadians with diabetes have type 2 diabetes.²

Incidence and Prevalence

Prevalence is defined as the portion of the population with a diagnosis, whereas incidence is the rate of new diagnoses. This scan reviewed data from Public Health Agency of Canada, British Columbia Centre for Disease Control, Statistics Canada Community Health Survey, Diabetes Canada reports and Health Authority reports. While there are differences in the data, all these sources indicate diabetes prevalence is increasing.

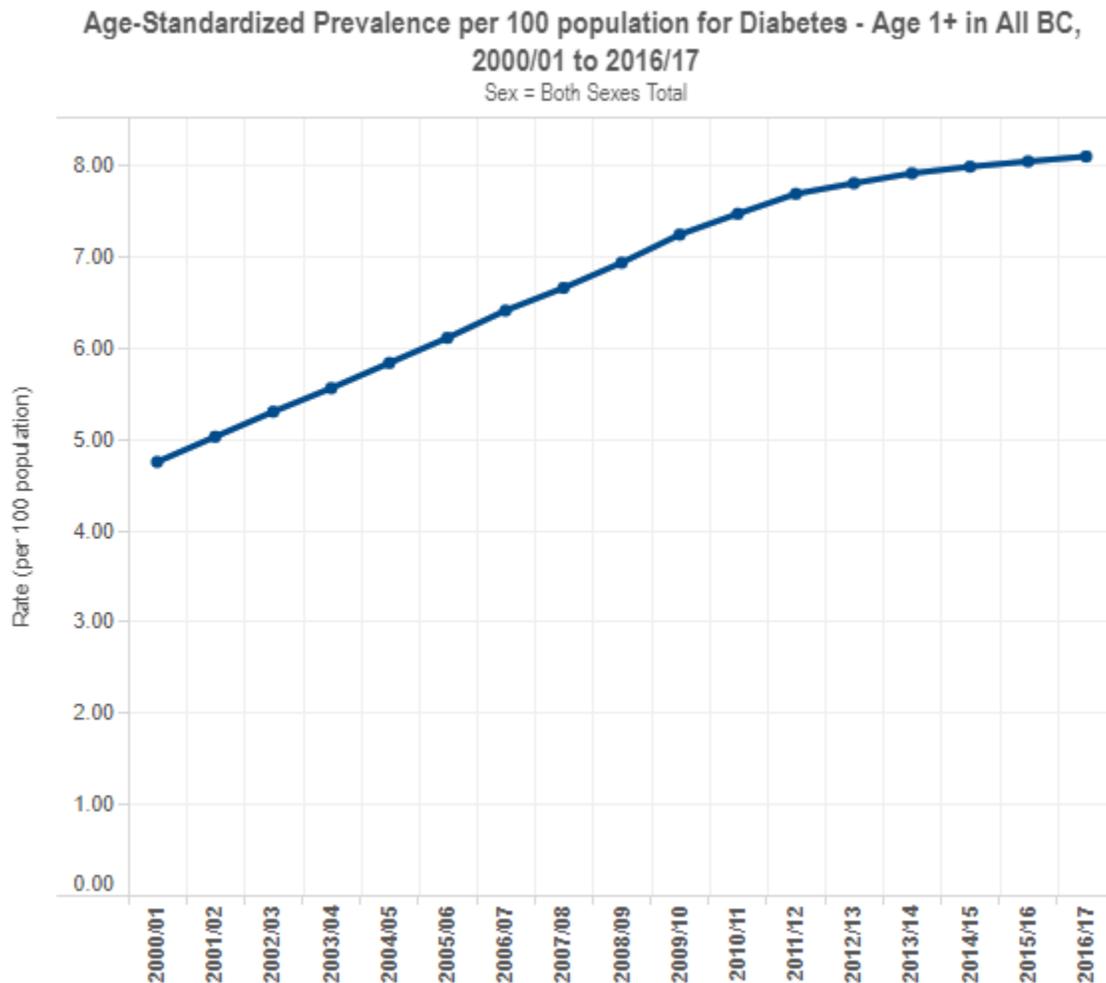
In 2018, approximately 501,000 British Columbians were living with a diabetes diagnosis, a total of 10% of the population. This represents an increase in prevalence of over 74% since 2007. In some minority community's prevalence is even higher, especially in First Nations, South Asian and Chinese populations. A recent University of Toronto study found that incidence of prediabetes was 40% higher among recent immigrants to Canada relative to long-term Canadian residents.

Prevalence is expected to increase another 37% by 2028, an increase that will be the second highest among Canadian provinces. Additionally, 1 in 3 people with diabetes is undiagnosed, and in 2017 approximately 765,000 British Columbians had prediabetes, a precursor to type 2 diabetes. In all that means over 1.4 million people, or 30% of BC's population, have diabetes or prediabetes.³⁴

A 2015 study by researchers at Providence Health Care (PHC) showed type 2 diabetes has drastically increased in people under 30, even surpassing type 1 diabetes⁵. In Caucasian youth with diabetes, 62% have type 2, among South Asian youth that number increases to 86%, and among Chinese youth it is 87%.

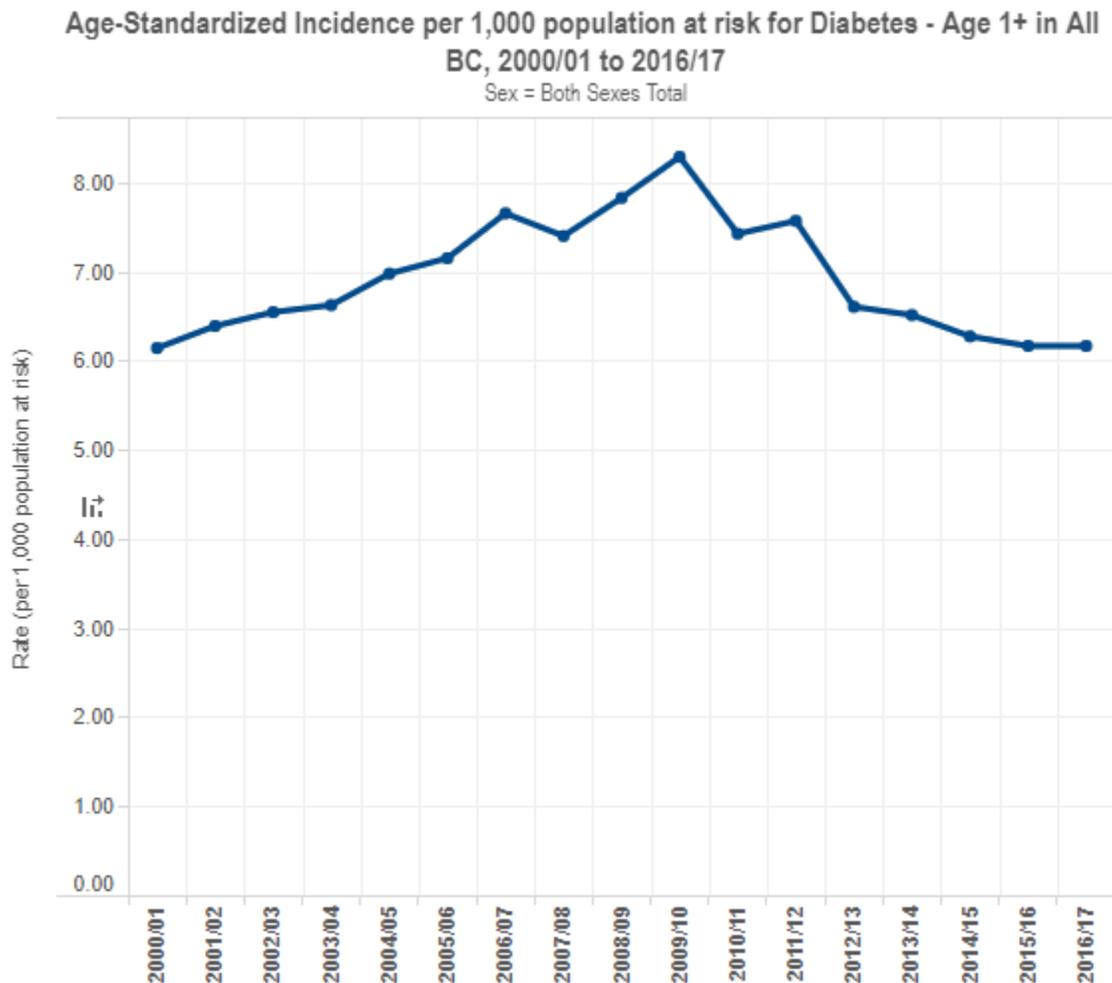
The historical rise in age-standardized prevalence is shown in Figure 1.

FIGURE 1: AGE-STANDARDIZED PREVALENCE OF DIABETES IN BC⁶



While age-standardized prevalence is expected to rise, the trend in age-standardized incidence is more complicated. As shown in Figure 2, the incidence rate in BC is down from its peak in 2009 of .83% to .62% in 2016. The increasing prevalence over the past few years can be mostly attributed to an aging population, while those living with type 2 diabetes, despite living with a chronic illness, are living longer.⁷⁸ However the incidence pattern is not fully understood, and a similar 2009 spike and subsequent decline in incidence has been seen in other provinces and is also reported in the United States. Some have suggested that this pattern may be an artifact resulting from increased awareness and/or diagnosis.⁹ Others, including the authors of a recent publication in the BMJ, believe that the declining incidence rates over the past decade are a legitimate reflection of the success of diabetes prevention policies and programs.¹⁰ Regardless, it appears that the incidence rate has stabilized and without intervention is likely to remain at or above six new diagnoses of type 2 diabetes per 1000 population every year.

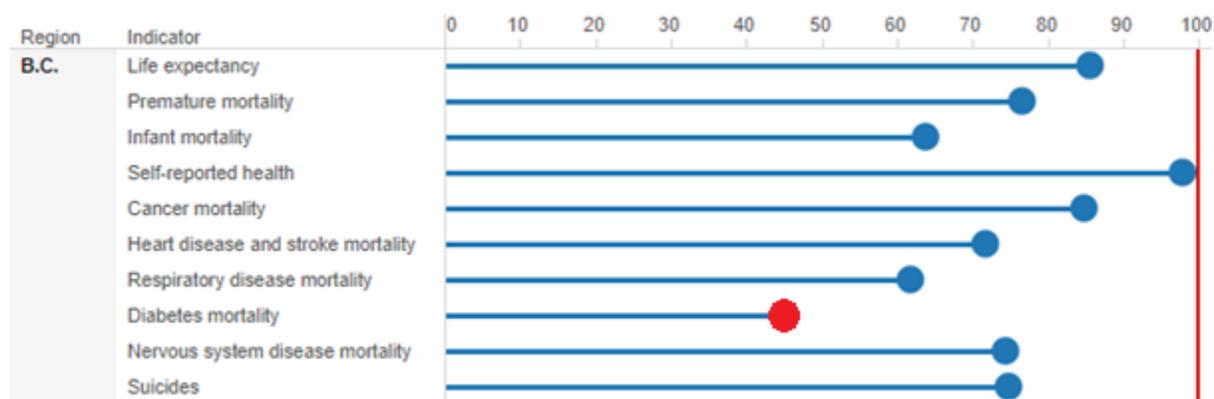
FIGURE 2: AGE-STANDARDIZE INCIDENCE OF DIABETES IN BC¹¹



Also hidden in the high-level statistics is how prevalence rates vary widely by region. The province-wide age-adjusted prevalence is 8.09%, but this varies from as low as 5.84% in Kootenay Boundary to as high as 10.39% in Fraser South.¹² Some of the differences in regions can likely be attributed to different ethnic makeup of the population, but there is some evidence that behavioural differences also contribute. For example, according to the Ministry of Health 70% of those living in Kootenay Boundary are physically active, the highest rate of any region in BC.¹³

According to the Conference Board of Canada, BC has the lowest prevalence rate of diabetes and overall is the healthiest province in Canada. BC has Canada’s highest share of those who are physically active, the lowest obesity rate in country, and the fewest per capita smokers and heavy drinkers. The only comparable regions in the world that received the same “A” health grade are Switzerland and Sweden. It is especially notable then that BC’s only “C” grade in the health report card comes in diabetes mortality, shown in Figure 3.¹⁴

FIGURE 3: BC'S CONFERENCE BOARD OF CANADA HEALTH REPORT CARD



Diabetes and the Social Determinants of Health

As with most chronic diseases, type 2 diabetes is inextricably linked with socioeconomic status and the social determinants of health. A recent analysis performed by the BC Centre for Disease Control shows exactly how a number of socioeconomic dimensions impact diabetes rates. For example, those with less than a high school education are 21% more likely to be diagnosed with diabetes than those who have completed post-secondary education, and being in the top income quartile appears to partially protect individuals from a diabetes diagnosis. When socioeconomic factors are combined in the Material Deprivation Index the results are even more striking, with an incidence rate among those who are most deprived 59% higher than those who are least deprived. Figure 4 shows the full results of this BCCDC analysis.

While studying the relationship between diabetes and obesity, IHSTS performed a novel analysis of the correlation between diabetes and obesity rates in OECD countries. The analysis showed that while obesity rates were correlated with diabetes rates, obesity alone only explains a small amount of variance in diabetes rates across countries. However, a country's GINI coefficient, which measures income inequality in a society, was twice as effective as a predictor of diabetes rates.

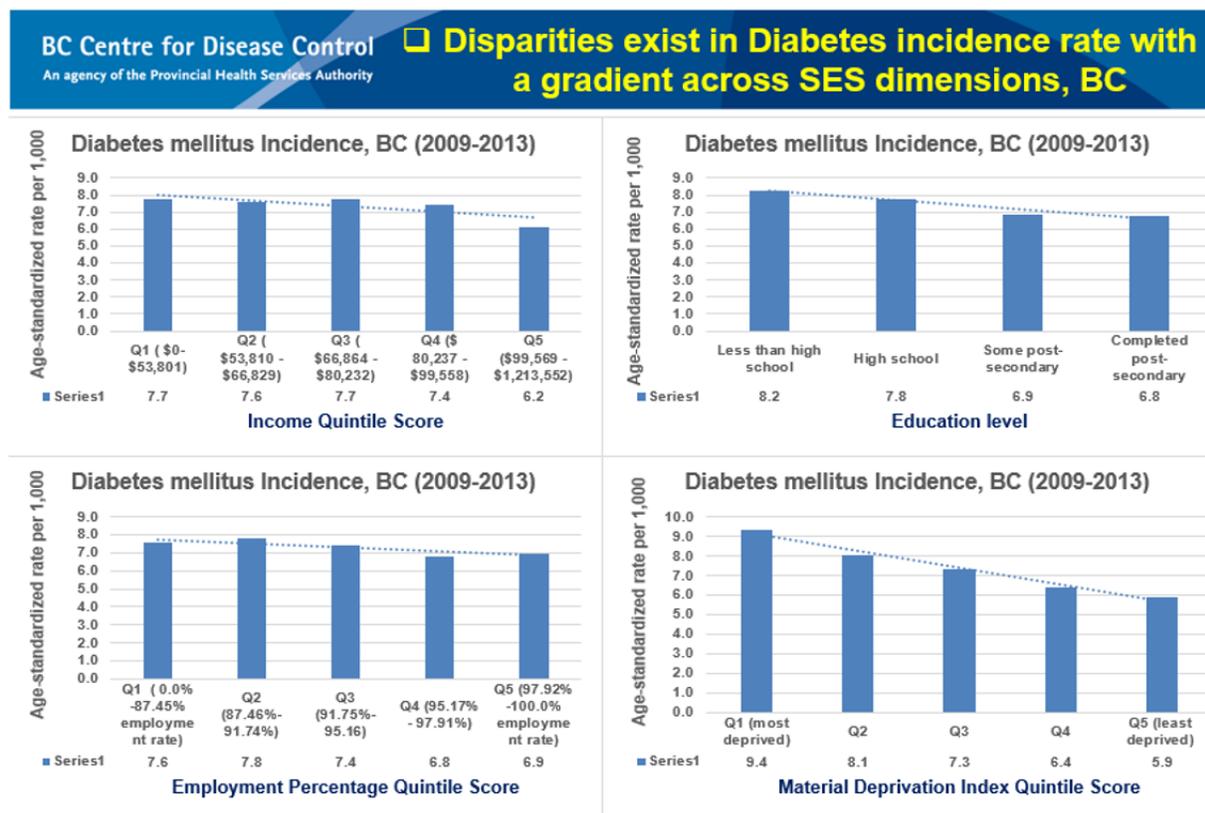
There are many mechanisms through which the social determinants of health influence diabetes rates in populations, and the social determinants themselves are interrelated. Some evidence-supported examples include:

- Those with more education have access to better jobs, and studies have shown those with higher education and income report higher leisure time physical activity.¹⁵¹⁶
- Those with higher income have greater access to healthy whole foods, and research shows consumption of processed foods is correlated with development of type 2 diabetes.¹⁷ The BC Centre for Disease Control has determined that the average monthly cost of a healthy diet for a family of four is over \$1000, showing the root cause of household food insecurity is lack of income.¹⁸ Poverty is also correlated with social isolation and poor mental health, both of which are in turn correlated with less healthy dietary makeup and increased chronic illness.¹⁹²⁰²¹

- Those with more education are more likely to learn about healthy behaviours and how to manage them. Studies have shown that those with more education are more adherent to self-management programs and less likely to switch to less-effective treatments.²²

Because of this inextricable link between the social determinants of health and type 2 diabetes, many of the interventions studied have some component of addressing the related social determinants of health. For example, many food security initiatives attempt to make healthy foods more widely available, and diabetes prevention programs often focus on improving access in less affluent communities. The scan did not find any evidence of attempts to directly influence the social determinants with a goal of reducing type 2 diabetes prevalence. For example, there were no studies found that looked at how universal basic income or free post-secondary education would influence type 2 diabetes prevalence or incidence.

FIGURE 4: ANALYSIS OF SOCIOECONOMIC DIMENSIONS AND DIABETES IN BC



Impact of Diabetes on Individuals and Society

The most significant negative impact of rising diabetes prevalence is the associated morbidity and mortality. Those with diabetes are more susceptible to a host of negative health outcomes including vision problems, cardiovascular events, amputations and renal failure. In all, those with diabetes in Canada are 75% more likely to die at any given age than those without it.²³ A recent study demonstrated that there has been no meaningful improvement in population-level treatment outcomes for those with diabetes in the United States since at least 2005, and the evidence we found suggests a similar lack of

improvement in Canada.^{24,25} For instance one study found the overall rate of diabetes-related amputations in Ontario to have increased between 2010 and 2016.²⁶

The economic burden of diabetes in society is also substantial. Diabetes Canada estimates direct diabetes costs to the BC health system of \$418 million every year. A PHSA study found at least 7 in 10 cases of type 2 diabetes are linked to excess weight, physical inactivity and smoking. The study found that a 1% relative decline annually in excess weight would avoid over \$7 billion in direct and indirect costs associated with chronic disease in BC by 2036.²⁷

A recent analysis by Marshal Dahl and Wendy Leong of provincial data and experiences provides more insights on health authority and hospital-level diabetes care management.²⁸ Their work provides a foundation for regional-level planning and improvement opportunities to reduce the burden of type 2 diabetes.

SCAN RESULTS

Strategy and Policy

This scan looked at what guiding strategy and policy are in place for type 2 diabetes in Canada. To a lesser extent, the international landscape was also reviewed.

British Columbia

At the provincial level, the BC Diabetes Care Guidelines and BC's Guiding Framework for Public Health are the most recent and relevant province-wide strategy and policy documents addressing diabetes prevention and management.

The BC Diabetes Care Guidelines²⁹, updated last in 2015 and scheduled for update in 2020, provide comprehensive clinical guidelines for the prevention, diagnosis and management for adult type 1 diabetes and type 2 diabetes patients. The guidelines include several recommendations and indicate the level of evidence supporting each recommendation. The guidelines are scheduled to be updated in 2020.

Key clinical recommendations summarized from the guidelines include:

- Care should be patient-centred.
- A variety of tests can be used for diagnosis based on the case.
- Screening for type 2 diabetes should occur every 3 years for those ≥ 40 years old and those at high risk.
- Glycemic targets should be based on patient age, duration of diabetes, life expectancy and risk factors.
- A "systemic" approach is recommended, including lifestyle management, glycemic control, blood pressure control and pharmacological interventions. Care should begin with a 2-3 month trial of lifestyle modification alone for most type 2 diabetes patients before beginning medication.

BC's Guiding Framework for Public Health³⁰, written in 2013 and updated in 2017, articulates a long-term vision for public health incorporating all major provincial public health strategies and could be viewed as the current type 2 diabetes prevention strategy in BC.

The most relevant section of the framework to diabetes is Goal 1: Healthy Living and Healthy Communities, which includes several objectives and measures related to nutrition and physical activity. The objectives focus on improving health through school-based programs, healthy built environments that encourage healthy choices and employer support for workers.

The framework includes a reduction in age-standardized incidence rate for diabetes from 6.3/1000 ppl in 2010 to 6 in 2023 as one of six overarching performance measures.

Other Provinces

A review of all Canadian provinces showed that most provinces do not have an active or published province-wide strategy specific to diabetes. The review did not look at the state of general population health strategies and policies.

Of the provinces that do have a diabetes strategy, Saskatchewan is the largest. The strategy was originally published in 2004 but the government reaffirmed its commitment to implementation in 2019.³¹ The strategy focuses on four components:

- Primary prevention and health promotion to prevent or delay type 2 diabetes.
- Optimum care and prevention through self-management, education and treatment, including risk factor assessment and programs for those at high risk.
- Education for providers to support self-management, care and prevention.
- Surveillance to support planning, delivery and evaluation.

Three of the Maritime Provinces have current strategies, with Nova Scotia's Diabetes Care Program Strategic Plan standing out.³² The strategy focuses on common topics such as knowledge generation and sharing, integration, data and collaboration.

Even though several provinces do not have an active diabetes strategy, many had strategies at some point in the past. For instance, Ontario had a strategy it was updating as recently as 2012.³³ As these past provincial strategies were unable to reverse the type 2 diabetes trend, it may be reasonable to argue that a successful approach in BC should challenge past assumptions and encourage true innovation.

Appendix 1 provides more details on strategies in place for each province.

National

At the national level there is no current strategy or plan focused on diabetes though there has been substantial work in diabetes planning in the past. The federal government spent \$115 million between 1999 and 2005 to develop a national diabetes strategy that was largely focused on surveillance and self-management.³⁴ However, shortly after publishing the framework, diabetes care was incorporated into the Healthy Living and Chronic Disease strategy and the focus shifted from diseases and conditions to risk factors. The federal government did implement several community-based diabetes programs that demonstrated some success but were not rigorously evaluated.³⁵

More recently, the Public Health Association of Canada's Centre for Chronic Disease Prevention: Strategic Plan 2016–2019 was set out as the federal way forward for diabetes prevention.³⁶ This plan focused on harnessing new technology, developing financial instruments to be used as policy levers, and engaging across sectors, all with the goal of accelerating discovery, innovation and breakthrough. The federal government is currently working to audit plan progress, with a report due summer 2019.

In the absence of a diabetes-specific national strategy, Diabetes Canada is working with stakeholders across the country to develop and advocate for a national strategic framework.³⁷ They are seeking \$150 million over seven years to address the "360" targets, which can be summarized as:

- 90% of Canadians live in an environment that prevents the development of diabetes
- 90% of Canadians are aware of their diabetes status
- 90% of Canadians living with diabetes are engaged in appropriate interventions
- 90% of Canadians engaged in intervention are achieving improved health outcome

A recent report from the Canadian Parliament's Standing Committee on Health recommends using Diabetes Canada's 360 strategy as a starting point for a new national strategy to prevent and manage diabetes. Recommendations of the report, which is based largely on expert testimony, include establishing a national diabetes registry, increasing community education and awareness programming with a focus on nutrition, improving provider education, and providing funding to cover the cost of diabetes-related expenses for those living with diabetes.³⁸ As of June 2019, federal or provincial funds have not been committed to Diabetes Canada to pursue this plan.

International

While this scan did not attempt to conduct a comprehensive review of diabetes strategies across the world, there were some highlights that emerged as we explored what other nations were doing to address the global epidemic.

Diabetes incidence appears to have stabilized in some OECD countries, but no country has been able to significantly decrease diabetes prevalence. A number of countries are however putting substantial resources into prevention and management.

England's National Health Service (NHS) has an Action Plan for Diabetes that is focused on quality improvement and reducing variability across the country.³⁹ It sets out specific roles for NHS as both a commissioner of services as well as areas in which it will provide leadership and support. Since the initial publication of this scan, the NHS has announced substantial new investment to expand their national diabetes prevention programme. This expansion includes large-scale trials of emerging interventions designed to induce type 2 diabetes remission. Based on this work, we consider England to be the global leader in population-level diabetes programming. Whether or not this program will result in population-level outcomes however remains to be seen.

Elsewhere in the UK, the Scottish Government has recently published a type 2 diabetes prevention and early detection plan and is focused on promoting a care pathway for those at high risk.⁴⁰

In the United States, the National Institutes of Health (NIH) publishes an annual emerging opportunities report, though much of this is dedicated to biomedical research.⁴¹ The NIH was also responsible for the landmark type 2 diabetes prevention trial, which is discussed in the next section of this report. At the state level there is also work being done. Washington State for instance publishes a Diabetes Epidemic and Action Report that makes broad-based recommendations to the legislature related to prevention and care.⁴² The National Academies of Science, Engineering and Medicine recently published a scan of emerging practices focused on the obesity pandemic, which has substantial overlap with type 2 diabetes strategies.⁴³

Individual and Population Interventions

The interventions section of this report is broken out into two broad categories of intervention: individual and population. For the purposes of this report, individual interventions are those that are delivered face-to-face by providers or counsellors, either one-on-one or in small groups. This includes clinical interventions like prescribing medications and lifestyle programs that require physician referral. Population interventions are those that are delivered to a broader audience, like public education and awareness campaigns, funding, tax or fiscal policies. Widely available mobile applications may be individual level tools (coaching) or more general (information) and could be seen as a population intervention.

For both individual and population interventions, those related to prevention, management and treatment of type 2 diabetes are included.

Individual Interventions

In 2002 the American National Institutes of Health (NIH) published the results of their Diabetes Prevention Program (DPP) trial, and the intensive lifestyle intervention protocols used in this trial were quickly adopted as best practice for type 2 diabetes prevention.⁴⁴⁴⁵⁴⁶⁴⁷ Later, similar protocols were adopted as best practice for type 2 diabetes management.⁴⁸⁴⁹⁵⁰⁵¹ The lifestyle interventions used in these programs included individual or small-group counselling on diet, exercise and behaviour modification skills. Similar programs were replicated in other countries and settings, most notably in another large trial in Finland.⁵²⁵³ Many of these programs implemented multi-year interventions, and some of them collected follow-up data as far as 15 years out.

In terms of both prevention and management, many of these programs demonstrated some success. In terms of prevention for high-risk individuals, at the 15 year follow-up DPP participants were 27% less likely to have a diagnosis than those in the regular care control group. Early reports from the UK-wide NHS diabetes prevention program claim that the 400,000 participants have lost on average 3.4kg of body weight. This success has led to a recent announcement that funding for the program will be doubled for the next five years.⁵⁴⁵⁵ A systematic review of similar prevention programs found substantial variation in weight loss and incidence rates.⁵⁶ One of the common conclusions of these analysis highlight the ability of these programs to delay, rather than prevent, onset of type 2 diabetes. An additional concern is that these programs are often unavailable in small, rural communities.⁵⁷ Despite these factors, a recent simulation demonstrated that a diabetes prevention program implemented nationwide in the United States would result in significantly fewer cases of diabetes and billions of dollars in cost savings.⁵⁸ This approach is supported by a study of over 100,000 individuals that showed a 50 year old who lives a low-risk lifestyle (exercises frequently, eats a healthy diet, does not smoke, is not a heavy drinker and is a healthy weight) can expect to live at least 10 years longer without diabetes than an individual who lives a high-risk lifestyle.⁵⁹

From a management perspective the results are of a similar scale and impact. Some programs demonstrated that those diagnosed with type 2 diabetes participating in intensive lifestyle intervention are more successful at losing weight and have improved biochemical markers (HbA1c, glycemic control and blood pressure). These results look durable over a long-term implementation of the study, though

the benefits decay slightly over time. The largest trial, called Look AHEAD, found that type 2 diabetes remission was possible but rare, with 4-year sustained remission occurring in 3.5% of those in the intervention arm.⁶⁰ A number of studies have shown that new models of care for diabetes management such as team-based and telehealth programs can be effective and should be further explored.^{61,62}

Historically there have been substantial mitigating factors that must be considered for intensive lifestyle intervention programs. The biggest challenge is that many qualifying individuals choose not to participate, and most studies successfully recruited less than one out of three individuals they invited. It is known that intensive counselling and lifestyle management programs for type 2 diabetes patients lead to better outcomes, but these initiatives require a large commitment from health professionals, and a recent study based in BC showed that simply providing incentives for physicians to deliver better care for chronic disease patients will not be sufficient.^{63,64} A critical analysis looking at the primary care setting suggests clinical inertia is one of the biggest challenges to improving care for those with type 2 diabetes.⁶⁵

The emerging lifestyle medicine movement is attempting to implement a more patient-centred approach to intensive lifestyle intervention programs. Early reports indicate this approach is effective, but more research is needed.⁶⁶ There is an active lifestyle medicine program in BC working on addressing these challenges.⁶⁷

From a cost-effectiveness standpoint, the DPP intensive lifestyle intervention was found to be cost effective at \$12,900/Quality-Adjusted Life Year (QALY), though the average participant gained only ~.14 QALY, a small effect.⁶⁸ A publication found the Look AHEAD trial for type 2 diabetes management cost between \$40,000 and \$100,000/QALY, rates which are generally not considered to be cost-effective.⁶⁹ A report suggested that focusing on high-risk individuals and delivering interventions in group settings can improve cost-effectiveness.⁷⁰

A promising emerging area of treatment for type 2 diabetes is therapeutic nutrition, which is the use of evidence-based nutrition therapies to achieve specific health goals. Often these therapies incorporate low-carbohydrate diets, which studies have found can be delivered safely to participants.⁷¹ Early studies have demonstrated substantial success in treating those diagnosed with type 2 diabetes, especially if the diagnosis is recent. One study showed average weight loss among participants of 13 kgs after one year, and remission rates as high as 60%.⁷² Another study showed remission in 36% of participants at 2-year follow-up, though the number in remission had declined from 48% at 1-year follow-up.⁷³ A mobile application delivering a therapeutic nutrition intervention found 40% of participants were able to reduce reliance on type 2 diabetes medications, and 26% were in remission after one year.⁷⁴ The American Diabetes Association considers the use of therapeutic nutrition for diabetes treatment to be an evidence-based consensus among top experts.⁷⁵ The Western Australia Education and Health Standing Committee has recently concluded a focus on therapeutic nutrition is the most viable way forward to reduce the burden of type 2 diabetes on society.⁷⁶ The Canadian Institute for Personalized Therapeutic Nutrition is attempting to scale therapeutic nutrition interventions in Canada.⁷⁷

A recent Lancet publication summarizes the pathophysiological mechanism of type 2 diabetes reversal, suggesting that loss of excess fat accumulation in the liver and pancreas can reduce metabolic stress and normalise blood glucose levels.⁷⁸ Given this pathway, we would expect that other diet-based

interventions to encourage weight loss may be effective at reducing or treating type 2 diabetes. In practice results are mixed. Very low calorie diets appear effective for those that can adhere to them, and the NHS is implementing large-scale trials of very low calorie diets for treatment of recently-diagnosed type 2 diabetes.⁷⁹ In another example, an extensive review of family-based behavioural childhood obesity interventions showed that they can be effective at reducing child weight.⁸⁰ However a meta-analysis of behavioural weight loss interventions in primary care settings showed very small effects that the authors conclude are unlikely to be clinically significant.⁸¹

Many clinics and health systems are experimenting with the use of telemedicine and mobile apps to augment type 2 diabetes treatment and management by healthcare professionals. One literature review found that telemedicine with healthcare feedback could be effective at promoting glycemic control in those with type 2 diabetes.⁸² A study by a private company focused on digital health coaching demonstrated that their digital program augmented by human coaches resulted in substantial weight loss to participants at 12-month follow-up.⁸³ Initial evidence from across the sector suggests these mobile apps and other digital innovations also result in small improvements to type 2 diabetes outcomes. However, researchers caution that there are currently no large-scale randomized trials demonstrating effectiveness.⁸⁴

In terms of pharmacology, some medications show a benefit in type 2 diabetes management, but no medications demonstrate consistent success in prevention or remission. Medications are often prescribed to control blood glucose, but there is an active debate in Canada and elsewhere regarding the standard of clinical care, with some concluding there is a lack of evidence to support the idea that tight glycemic control leads to better outcomes for patients.⁸⁵ However, most clinical guidelines still include tight glycemic control in care guidelines. As mentioned in the strategy and policy section, the BC guidelines encourage an attempt at management through lifestyle intervention before resorting to medication.

In addition to lifestyle intervention, the DPP included an arm using the drug Metformin for type 2 diabetes prevention. That arm was 18% less likely to have a type 2 diabetes diagnosis at 15-year follow-up. Interestingly, a cost-effectiveness analysis found Metformin to be not only cost-effective but in fact cost-saving, with no long-term improvement in outcomes but a significant long-term decrease in overall health care costs for those taking the drug for prevention.⁸⁶

A review of early insulin therapy for type 2 diabetes showed better glycemic control early in the course of the disease can lead to long-term benefits. One 20-year follow-up for type 2 diabetes patients treated with early insulin therapy found a relative risk reduction in all-cause mortality of 13%.⁸⁷

Additionally, some pharmacological interventions to prevent complications resulting from type 2 diabetes are supported by evidence. A number of publications provide evidence that use of drugs to control blood pressure is effective at reducing mortality in type 2 diabetes patients,⁸⁸ and there is some evidence to support use of other drugs such as Empagliflozin to prevent cardiovascular events.⁸⁹

Finally, bariatric surgery has been shown to be highly effective at treating type 2 diabetes, especially in very overweight individuals. A large systematic review found 78% of these very overweight type 2

diabetes patients experienced complete remission after bariatric surgery.⁹⁰ An extensive report produced by the Belgian Health Care Knowledge Centre concluded that bariatric surgery was by far the most effective long-term treatment for those with BMI > 35, and that type 2 diabetes patients with lower BMI also benefit from the surgery.⁹¹

Population Interventions

There are few population-level interventions that specifically target type 2 diabetes. Most population interventions relevant to the scope of this scan target risk factors and aim to improve diets or increase physical activity.

A number of jurisdictions have recently imposed taxes on high-calorie, sugar-sweetened beverages (SSB).^{92,93,94} The results of these implementations have been mostly positive. While most jurisdictions show a clear decrease in consumption of taxed beverages, substitution effects (switching to other high-calorie beverages) and retailer pricing strategies (decreasing the cost of large format containers) can mitigate potential benefits. It appears that taxes are more likely to be successful at modifying consumption if they are large and cover a wide range of potential substitutes. A study simulating the impact of a large (20%) tax on SSBs and sugary fruit juices in Canada found such a tax would prevent 900,000 new cases of type 2 diabetes over the next 25 years.⁹⁵ Other initiatives to decrease consumption of SSBs such as improving availability of drinking water and promoting healthier drink options in retail settings have seen mixed results.⁹⁶

Food security initiatives are widespread in BC and elsewhere. An extensive review by the BC Ministry of Health found strong evidence that building community capacity through community empowerment has successfully improved food systems in BC communities.⁹⁷ Another review noted mixed evidence, showing food insecurity was correlated with obesity in women and children but with lower weight in men.⁹⁸ Both reviews concluded more evidence is needed to understand the clinical significance and impact of food security initiatives.

Other population-level nutrition interventions show promise but are still in early stages of implementation. Food reformulation efforts have successfully decreased sodium in the food system and could potentially be leveraged to reduce sugar.⁹⁹ Food labelling strategies and related educational supports require considerable research to understand opportunities. Menu labelling policies that require restaurants to display calorie information on menus and display boards appear to successfully decrease energy consumption among customers in some restaurants.¹⁰⁰ Experimental trials of a 5-colour (“traffic light”) front-of-pack nutritional labeling system implemented across much of Europe have shown the scores are associated with higher nutritional quality of purchases, but evidence that this has yet impacted population health in a measurable way was not found.¹⁰¹ Many organizations are advocating for bans on junk food advertising targeted at children, though the success of these campaigns is mixed.^{102,103} The UK-based Institute for Public Policy Research recommends more extreme measures such as mandating plain packaging for unhealthy foods and banning fast food restaurants in proximity to schools, though there is insufficient evidence to assess what impact these interventions would have on population health.¹⁰⁴

The most recent changes to the Canada food guide appear to be generating considerable discussion and present many important research questions. Health Canada's approach to the reframing of the guide was disciplined and rigorous in the application of the scientific evidence, and the guide recommends a diet consisting mostly of plant-based whole foods. A recent meta-analysis that included over 300,000 participants shows this new guide is a step in the right direction as it concluded that type 2 diabetes prevalence is lower among those who adhere to plant-based diets, and other studies have shown plant-based diets to be beneficial in type 2 diabetes prevention.¹⁰⁵¹⁰⁶ Implementation at the provincial level is currently underway.

Many cities and towns have modified community planning practices or implemented other policies to encourage active transport and physical activity. This approach is supported by substantial evidence. For instance, a recent analysis from UBC found those living in more walkable neighbourhoods were 17% more likely to meet the weekly recommended level of physical activity, 42% less likely to be obese and 39% less likely to have diabetes.¹⁰⁷ A number of these programs to improve the built environment, such as modifying cities to make active transport safer, have demonstrated some success in increasing physical activity in populations.¹⁰⁸¹⁰⁹¹¹⁰¹¹¹¹¹² Policies that specifically target health outcomes rather than policies with less targeted outcomes (ex. planning for more green space) appear more likely to successfully change behaviour. One review found the construction of bike trails to be the most cost-effective population-level physical activity intervention.

A recent systematic review of interventions to improve physical activity concluded that there is no single best way to encourage physical activity.¹¹³ However there is growing evidence that programs promoting the use of pedometers – devices that measure steps taken - encourage people to be more active.¹¹⁴ The BC government's Carrot health app is a good local example, which uses participants' phones as pedometers. An evaluation of the program found those using it walked on average 116 more steps/day, with a larger effect for those that were least active. While some claim that even a small increase in physical activity at the population level will result in better population health outcomes, a trial specifically looking at increased step count and type 2 diabetes found participants needed to increase their step counts by at least 4000 steps per day to see any measurable positive impact.¹¹⁵

Using online platforms and applications like Carrot to encourage behaviour change is becoming more popular, though the most recent systematic review of such platforms is from 2010. This review found online programs had small but measurable effects on health behaviours.¹¹⁶ Another analysis found social support through social media to be a useful tool in multifactorial weight loss interventions.¹¹⁷ A recent high-quality trial of a rigorously-designed web-based self-management program for type 2 diabetes showed improvements in diabetes-related biomarkers and decreased healthcare costs for those using the program.¹¹⁸ Another recent analysis of a web-based dietary self-management program based on Diabetes Canada's Glycemic Index guidelines showed those using the tool reported a reduction in daily glycemic intake.¹¹⁹ Mass media campaigns to change health behavior have mixed results.¹²⁰ There is some evidence that campaigns have a short-term effect which decays over time after campaigns have ended.

A recent systematic review of all population-level nutrition and physical activity interventions concluded that while there is some evidence that these interventions can improve diet or increase physical activity,

there is not yet any evidence that they can influence behaviour to the extent required to have a significant impact on overall obesity/overweight in the population.¹²¹

Programs and Organizations

Throughout the process of the scan, several programs and organizations providing different approaches to diabetes prevention, management and research were identified. This section provides a bulleted list and short description of some of the cross-sector organizations responsible for this work, with a focus on organizations active in BC. This is not a comprehensive list and it is likely that much more work is happening at the community level, as demonstrated by our Kelowna Community Profile (Appendix 2).

Organizations and programs in each section are listed in alphabetical order.

Prevention

- The BC Alliance for Healthy Living Society is an advocacy group that looks to hold the government responsible for promoting wellness and preventing chronic disease.¹²²
- The BC Food Security Gateway provides information and resources related to food security initiatives.¹²³
- The BC Healthy Communities Society's PlanH facilitates local government learning, partnership development and planning for healthier communities.¹²⁴
- The BC Healthy Built Environment Alliance supports the creation of BC communities that promote health.¹²⁵
- Cities Changing Diabetes, an initiative that includes the City of Vancouver, is a partnership that challenges cities to hold the rise of diabetes prevalence at 10.0% globally.¹²⁶
- Food Skills for Families is a hands-on curriculum focusing on healthy eating, grocery shopping and cooking.¹²⁷
- Healthy Families BC runs programs that encourage individuals and families to make healthier choices.¹²⁸
- The Pan-Canadian Public Health Network Partners in Public Health is a national network of individuals from many levels of government looking to strengthen public health.¹²⁹
- SCOPE is a BC Children's Hospital program that helps communities implement initiatives that make healthy choices easier children and their families.¹³⁰
- Shapedown BC is a BC Children's Hospital program to help children manage weight.¹³¹
- The South Asian Health Institute at Fraser Health empower the community to make healthy choices.¹³²

Management

- The Abbotsford Division of Family Practice has developed a team-based care calculator that calculates the multidisciplinary resource needs to care for those with diabetes.¹³³
- The British Columbia Alliance on Telehealth Policy and Research provides evidence and capacity building for sustainable telehealth services.¹³⁴
- CHANGE BC is the Pacific Northwest Division of Family Practice's year-long physician-led lifestyle change program.¹³⁵
- Child Health BC provides care for children diagnosed with diabetes in the community and school settings.¹³⁶

- Diabetes Canada engages in advocacy, policy and research to help those with diabetes live healthier lives and to push for a cure to diabetes.¹³⁷
- Diabetes clinics across the province, provided by most health authorities, help individuals manage diabetes through clinical and education programs.¹³⁸¹³⁹¹⁴⁰¹⁴¹¹⁴²
- Health Link BC is a 24-hour non-emergent health line that includes diabetes resources.¹⁴³
- The Institute for Personalized Therapeutic Nutrition is a multidisciplinary alliance promoting a “food first” culture for treating chronic disease.¹⁴⁴
- McMaster University’s Aging, Community and Health Research Unit (ACHRU) has a large grant to search for ways to support older adults living with diabetes together with other chronic diseases¹⁴⁵
- The Medical Weight Management program assesses and treats patients with obesity through intensive group therapy.¹⁴⁶
- Revive Lifestyle Medicine is an internist-led clinic in Victoria that provides an 8-week chronic disease reversal program.¹⁴⁷
- Self-Management BC is a University of Victoria initiative offering programs to promote self-management of chronic disease across BC, including in-person and telephone-based support.¹⁴⁸
- Surrey-North Delta Division of Family Practice provides diabetes management programs that include culturally appropriate interventions.¹⁴⁹

Research

- The BC Chronic Disease Dashboard provides the most up-to-date chronic disease surveillance data, including geographical breakdown.¹⁵⁰
- The BC Diabetes Research Network is a group of researchers across BC universities focused on diabetes.¹⁵¹
- The Canadian Institutes of Health Research are funding collaborative research project teams focused on tackling diabetes.
- The Community Health Research Team (CoHeaRT) at SFU studies the population determinants of health for obesity and other chronic diseases.¹⁵²
- Diabetes Action Canada conducts Patient Oriented Research focused on complications of diabetes.¹⁵³
- Diabetes BC is a clinic in Vancouver that conducts several type 2 diabetes clinical trials as well as provides clinical management services.¹⁵⁴
- LIVWELL is a group of researchers at SFU working towards living well with chronic disease.¹⁵⁵
- The Institute of Nutrition, Metabolism and Diabetes at the Canadian Institutes of Health Research supports research related to primary causes, prevention, screening, treatment and support systems for illnesses including diabetes.¹⁵⁶
- The Michael Smith Foundation for Health Research funds approximately \$12 million in yearly grants for health research.¹⁵⁷

DISCUSSION

The objectives of this scan were to identify practices, policies, guidelines and research occurring in the area of type 2 diabetes, and to highlight areas that may have promise to change the trend of increasing prevalence rates. To this end, this scan has identified a number of promising practices that should be pursued in an effort to reverse the trend in type 2 diabetes:

1. This review identified clinical management strategies that indicate remission is possible and that type 2 diabetes must be reframed as a reversible condition. More specifically, there is strong evidence that bariatric surgery, low calorie diets, and low carbohydrate diets can be successful in reversing type 2 diabetes in individuals. Research to establish the sustainability and scalability of these approaches is urgently needed and should be prioritized across the health system.
2. Many diabetes prevention and management programs delivered in Canadian communities failed to conduct long-term follow-up with participants or publish evaluations subjected to peer review. As a result, it is challenging to know how the programs actually impacted diabetes incidence or reversal. Any future programmatic funding should be integrated at the strategic level. This funding should mandate rigorous, controlled evaluations, developed and delivered in partnership with research institutions, with the specific goal of publishing peer-reviewed outcomes and scale-up simulations to determine the impact of the interventions if they were to be delivered at the population level.
3. Given the importance of the social determinants of health in type 2 diabetes prevalence and incidence, and the burden of type 2 diabetes on individuals and society, governments and institutions should explore policies that aim to reduce poverty and increase education with the explicit goal of preventing type 2 diabetes.
4. Taxes on high-calorie or high-sugar products and food reformulation initiatives to remove sugar from the food system are effective tools to change the food system. Governments must overcome the political barriers to these interventions if they wish to measurably decrease population-wide diabetes prevalence.
5. Interventions that promote increased activity and create behavior change at the individual and population level are known to benefit overall health. While the direct impact on reducing type 2 diabetes is not clear, programs in this area should continue to be pursued.
6. Important changes to the Canada Food guide have recently been published by Health Canada. The impact of these changes should be closely monitored and implementation of the guide should continue to consider emerging evidence.
7. There are pilot programs operating in BC at the primary care level using a team-based, multidisciplinary approach that is personalized for the individual and focused on nutrition and lifestyle changes. Early results from these programs show success in preventing and reversing type 2 diabetes.¹⁵⁸ These programs should be supported, funded and spread across the system.

APPENDICES

Appendix 1: Strategic overview of diabetes system at provincial and federal level

Province	Strategic Overview
BC	<ul style="list-style-type: none"> • BC has no active provincial diabetes strategy or plan • BC Diabetes Care Guidelines (2015) provide clinical care standards. The standards emphasize patient-centred care, and encourage a systematic approach beginning with lifestyle management. • BC's Guiding Framework on Public Health (2013) articulates a long-term vision for public health, including objectives related to health education in schools, healthy built environments and workplace health. A number of outcome measure are related to healthy living and physical activity, and one of the six overarching performance measures is a decrease in obesity incidence.
Alberta	<ul style="list-style-type: none"> • Alberta had a diabetes strategy from 2003-2013 that focused almost exclusively on prevention. They do not appear to have a current strategy. • Alberta Health Services (AHS) has a Strategic Clinical Network for diabetes, obesity and nutrition. The network is focused on clinical-care innovation through connecting of clinicians and patient advisors.
Saskatchewan	<ul style="list-style-type: none"> • Saskatchewan has a provincial diabetes plan that was released in 2004 but reaffirmed by the government in 2019. • The plan focuses on four components: Primary prevention of type 2 diabetes; Optimum care through self-management, education and treatment; Education for care providers; Diabetes surveillance. • Diabetes Canada is running a large public awareness and donation drive in 2019 with over 4000 volunteers.
Manitoba	<ul style="list-style-type: none"> • The most recent diabetes strategy available online is from 1998 • Most of the diabetes activity in Manitoba appears related to Diabetes Canada • The Winnipeg Regional Health Authority offers an extensive education program for children and adolescents with diabetes • University of Manitoba runs a large research group called Diabetes Research Envisioned & Accomplished in Manitoba (DREAM)
Ontario	<ul style="list-style-type: none"> • The most recent Ontario Diabetes Strategy was published in 2009, with updates as recently as 2012. Priorities included greater access to primary care, testing within guidelines and more how dialysis, supplies and bariatric surgeries. Updated priorities included more focus on prevention initiatives and patient-centred care, including establishment of diabetes regional coordinating centres in each of the 14 health regions. • Ontario has six Centres for Complex Diabetes Care, which provide specialized care to patients including education, monitoring for continuous care improvement, and training for health providers. • Other initiatives and programs include a pediatric initiative for type 1 diabetes, a diabetes complications prevention strategy and an aboriginal diabetes initiative.
Quebec	<ul style="list-style-type: none"> • No provincial strategies or plans were identified • The Cardiometabolic health, Diabetes and Obesity Research Network, as part of Fonds de recherche Sante Quebec, is a large granting and research organization doing substantial work in the space.

Province	Strategic Overview
New Brunswick	<ul style="list-style-type: none"> • A Comprehensive Diabetes Strategy for New Brunswickers 2011-2015 provides a vision for diabetes care and prevention in the province. Priorities include capacity building, prevention, detection and management. The plan does not appear to have been renewed.
Newfoundland	<ul style="list-style-type: none"> • Newfoundland does not have an active or recent diabetes strategy or plan. The most recent strategy was published in 2006, which promoted more provincial coordination in diabetes prevention, screening, management and treatment of complications. • The 2017-2018 Chronic Disease action plan includes specific mention of diabetes in many priorities, including education for providers, remote patient monitoring, case management, wound care and surveillance. They also prioritized the development of a diabetes flow sheet to standardize care (could not find online), and certification in insulin dose adjustment.
PEI	<ul style="list-style-type: none"> • PEI Diabetes Strategy 2014-2017 focuses on: Prevention through public awareness and personal health management, especially for high-risk populations; Detection through screening according to guidelines; Management through primary care, home care and hospital care innovations. • They are in the process of renewing the strategy, the new strategy is not yet published. • The Provincial Diabetes Program provides education, counselling and personal assessments.
Nova Scotia	<ul style="list-style-type: none"> • The Nova Scotia Health Authority Diabetes Care Program Strategic Plan (2014-2019) was developed through extensive consultation and provides a vision for diabetes care. It focuses on four strategic directions: Create and share knowledge through collaboration; Lead the development of an integrated system of diabetes management to reduce/delay diabetes development and progression; Use data to set targets; Work collaboratively with other departments and organizations. • They have 38 diabetes centres across the province that provide providers and patients access to multidisciplinary diabetes teams, help coordinate care with other disciplines, promote linkages to community services and provide specialized management.
Federal	<ul style="list-style-type: none"> • No active diabetes strategy. • The government spent \$115 million between 1999 and 2005 to develop a national diabetes framework, largely focused on surveillance and self-management. They implemented a number of community-based programs which were not rigorously evaluated. • Shortly after publishing the framework, diabetes care was incorporated into Healthy Living and Chronic Disease strategy and the focus shifted to risk factors. • The Centre for Chronic Disease Prevention: Strategic Plan 2016–2019 was intended to be the way forward. It is unclear if this strategy is being implemented, or what comes next.

Appendix 2: Kelowna diabetes prevention and management community profile

The following Kelowna community profile was developed as an example to illustrate the scope, scale and involvement of organizations in diabetes prevention and management at the community level.

Organization	Program	Details
Interior Health	Diabetes Clinic	<ul style="list-style-type: none"> • Clinic that offers a diabetes education program as well as clinical care when appropriate. • They have a physician in the office once per week to deal with medication and complex cases. Generally requires a referral.
Interior Health	Diabetes Education Program	<ul style="list-style-type: none"> • Education and clinical support to manage diabetes and reduce risk of complications through the Interior Health's Diabetes Clinic. • Programs include: Getting Started Classes, Individual Assessments, Staying on Track, Refresher Class, Pre-Diabetes Class, Gestational Diabetes classes and counselling • They refer children to the Small Steps for Big Changes program. • Offered at 3 locations, both appointments and drop in. • Multi-day group class delivered in three parts. First two classes are one week apart, and the final class is a month later. Follow-up 1:1 counselling is then available if needed. Classes are delivered by a diabetes nurse and a dietician. • Must be diagnosed with diabetes or have pre-diabetes elevated blood sugar levels. • Classes are free with MSP. • They encourage drop-in or participants but also accept referrals. • https://kelowna.cioc.ca/record/KNA1095
UBCOK	Diabetes Prevention Research Group	<ul style="list-style-type: none"> • Run a number of programs in the community, the most notable being Small Steps for Big Changes. http://dprg.ok.ubc.ca/
Canadian Diabetes Association	None	<ul style="list-style-type: none"> • Canadian Diabetes Association only does donation pickups in Kelowna. They referred to the diabetes clinic.
Kelowna YMCA and UBCOK	Small Steps for Big Changes	<ul style="list-style-type: none"> • Free program offered monthly at the Kelowna Downtown YMCA and the Kelowna Family YMCA. • The program is an evidence-based lifestyle modification course that uses motivational interviewing techniques. Participants are paired 1:1 with a trained coach and complete 6 sessions of exercise and dietary change counselling over 3 weeks.

Organization	Program	Details
		<ul style="list-style-type: none"> • Post-program there is a 1-, 6-, and 12-month follow-up. • Track diet and exercise with a health app and fitness watch provided by the program. • Includes 2 types of exercise: 1) Continuous exercise at a steady pace for 20-30 minutes and, 2) Interval exercise that involves alternating between a brief bout of higher-intensity activity followed by a bout of lower-intensity activity for 12-15 minutes. • Recruitment is open to those who are between the age of 18-70, have a BMI between 22-45 kg/m², and confirmed in the pre-diabetic range. Individuals can confirm their eligibility by: 1) Speaking with their doctor and complete a blood test to determine their A1c score and/or, 2) contact Small Steps for Big Changes directly at (250-807-8419) or (small.steps@ubc.ca) to complete a risk assessment test and eligibility screening. • Currently in the study phase. They are hoping to demonstrate program effectiveness at the community-level and implement it as a permanent program. • http://ok-smallsteps.sites.olt.ubc.ca/
Self-Management BC, UVic, YMCA	Diabetes Self-Management Program Workshop	<ul style="list-style-type: none"> • The Diabetes Self-Management Program Workshop hosts weekly sessions over six weeks. • It is delivered in group sessions of 10-16 people. • It is hosted out of downtown YMCA. They run sessions a few times per year. • For people diagnosed with type 2 diabetes • Program guide here.
The Bridge Youth and Family Services	Healthy Together	<ul style="list-style-type: none"> • Children's Health Program looking to promote achievement and maintenance of healthy weights, particularly for under-served populations including aboriginal, minority and rural groups. • The program is funded through PHAC's education strategy. • Uses prevention, family education and group learning to promote prevention, healthy nutrition, physical activity and support. • The program provides a toolkit and facilitator training. The program is available at over a dozen sites across BC, and many more across Canada.

Organization	Program	Details
		<ul style="list-style-type: none"> While their head office is in Kelowna they do not have the program running there. They are hoping to run a session fall 2019.
Pearson Elementary School	Family Hub	<ul style="list-style-type: none"> Family hub suggested the hardest thing in the community is finding a family doctor to manage type 2 diabetes. They recommended filling out the application on the Division of Family Practice website http://www.divisionsbc.ca/central-okanagan They also recommended contacting the YMCA and the Diabetes Education Clinic.
Private insurers	Prevention and management programs	<ul style="list-style-type: none"> Many private insurers in BC offer lifestyle management programs as part of their insurance bundles. Some employers also offer fitness or diet reimbursement programs.
Private organizations	Prevention and management programs	<ul style="list-style-type: none"> As with elsewhere in the province, those living in Kelowna have access to an array of private for-pay weight loss solutions including gyms and diet programs.

References

- ¹ National Institute of Diabetes and Digestive and Kidney Diseases <https://www.niddk.nih.gov/health-information/diabetes/overview/risk-factors-type-2-diabetes>
- ² Diabetes Canada <https://www.diabetes.ca/getmedia/67244d78-2993-48f1-87a6-8ecfebaf8bb/2019-Backgrounder-British-Columbia.pdf.aspx>
- ³ Diabetes Canada https://www.diabetes.ca/getmedia/8e38f0cd-a2c4-4c17-a7df-9a2b385df961/sv-2017-Diabetes-in-BC_final_HQ.aspx
- ⁴ Diabetes Canada https://www.diabetes.ca/getmedia/6625588a-e6a6-498b-aa6a-446c91fd81a6/2018-Backgrounder-British-Columbia_JK_AB_KB-edited-13-March-2018_1.pdf.aspx
- ⁵ Providence Health Care <http://www.providencehealthcare.org/news/20150128/type-2-diabetes-overtakes-type-1-diabetes-young-people>
- ⁶ BC Centre for Disease Control <http://www.bccdc.ca/health-professionals/data-reports/chronic-disease-dashboard>
- ⁷ Public Health Agency of Canada <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>
- ⁸ At-a-glance – Twenty years of diabetes surveillance using the Canadian Chronic Disease Surveillance System

<https://www.canada.ca/en/public-health/services/reports-publications/health-promotion-chronic-disease-prevention-canada-research-policy-practice/vol-39-no-11-2019/twenty-years-diabetes-surveillance.html>

⁹ Declines in the Incidence of Diabetes in the U.S.—Real Progress or Artifact?

<http://care.diabetesjournals.org/content/40/9/1139>

¹⁰ Trends in incidence of total or type 2 diabetes: systematic review

<https://www.bmj.com/content/bmj/366/bmj.l5003.full.pdf>

¹¹ BC Centre for Disease Control <http://www.bccdc.ca/health-professionals/data-reports/chronic-disease-dashboard>

¹² BC Centre for Disease Control <http://www.bccdc.ca/health-professionals/data-reports/chronic-disease-dashboard>

¹³ Active People, Active Places: British Columbia Physical Activity Strategy

<https://www.health.gov.bc.ca/library/publications/year/2015/active-people-active-places-web-2015.pdf>

¹⁴ Conference Board of Canada

<https://www.conferenceboard.ca/hcp/default.aspx?AspxAutoDetectCookieSupport=1>

¹⁵ Why Education Matters to Health: Exploring the Causes

<https://societyhealth.vcu.edu/work/the-projects/why-education-matters-to-health-exploring-the-causes.html>

¹⁶ Active People, Active Places: British Columbia Physical Activity Strategy

<https://www.health.gov.bc.ca/library/publications/year/2015/active-people-active-places-web-2015.pdf>

¹⁷ Ultraprocessed Food Consumption and Risk of Type 2 Diabetes Among Participants of the NutriNet-Santé Prospective Cohort

<https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2757497>

¹⁸ The Affordability of Healthy Eating in BC

<http://www.bccdc.ca/pop-public-health/Documents/food-security-infographic-2017.pdf>

¹⁹ Poverty, Sense of Belonging and Experiences of Social Isolation

<https://www.tandfonline.com/doi/abs/10.1080/10875540902841762>

²⁰ Poverty and Mental Illness

<https://ontario.cmha.ca/documents/poverty-and-mental-illness/>

²¹ Social relationships and healthful dietary behaviour: Evidence from over-50s in the EPIC cohort, UK

<https://www.sciencedirect.com/science/article/pii/S027795361300470X>

²² Can patient self-management help explain the SES health gradient?

<https://www.pnas.org/content/99/16/10929>

²³ <https://infobase.phac-aspc.gc.ca/ccdss-scsmc/data-tool/>

²⁴ Evaluation of the Cascade of Diabetes Care in the United States, 2005-2016

<https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2740801>

²⁵ Type 2 diabetes mellitus management in Canada: is it improving?

<https://www.ncbi.nlm.nih.gov/pubmed/24070797>

²⁶ Foot and leg amputation related to diabetes and poor circulation on the rise in Ontario

<https://www.ices.on.ca/Newsroom/News-Releases/2019/Foot-and-leg-amputation-related-to-diabetes-and-poor-circulation-on-the-rise-in-Ontario>

²⁷ Provincial Health Services Authority http://krueger.ca/wp-content/uploads/edd/2015/12/Economic_Benefits_of_Risk_Factor_Reduction_in_BC.pdf

²⁸ Marshall Dahl and Wendy Leong. Abstract. BC Provincial Diabetes Evaluation: A quantitative and qualitative environmental scan of diabetes care management in BC. Canadian Diabetes Association 2016 Professional Conference

²⁹ Diabetes Care Guidelines <https://www2.gov.bc.ca/>

³⁰ Promote, Protect, Prevent: Our Health Begins Here. BC's Guiding Framework for Public Health

<https://www2.gov.bc.ca/gov/content/health/about-bc-s-health-care-system/health-priorities/bc-s-guiding-framework-for-public-health>

³¹ Provincial Diabetes Plan <https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/saskatchewan-health-initiatives/provincial-diabetes-plan>

- ³² Diabetes Care Program of Nova Scotia Strategic Plan <http://diabetescare.nshealth.ca/about-us/strategic-plan-2008-2012>
- ³³ Ontario Diabetes Strategy – Newsletter
<http://www.ontla.on.ca/library/repository/ser/298511/2011no07june.pdf>
- ³⁴ Building a national diabetes strategy: a strategic framework
http://publications.gc.ca/collections/collection_2008/phac-aspc/HP5-5-2-2005E.pdf
- ³⁵ Canadian Diabetes Strategy Community-Based Program <https://www.canada.ca/content/dam/phac-aspc/migration/phac-aspc/cd-mc/diabetes-diabete/rhd-rds-2011/pdf/rhd-rds-2011-eng.pdf>
- ³⁶ Centre for Chronic Disease Prevention: Strategic Plan 2016–2019 <https://www.canada.ca/en/public-health/services/chronic-diseases/centre-chronic-disease-prevention-strategic-plan-2016-2019-improving-health-outcomes-a-paradigm-shift.html>
- ³⁷ Diabetes 360^o: A Framework for a Diabetes Strategy for Canada <https://www.diabetes.ca/campaigns/diabetes-360%C2%B0-strategy>
- ³⁸ A Diabetes Strategy for Canada
<http://www.ourcommons.ca/Content/Committee/421/HESA/Reports/RP10365941/hesarp23/hesarp23-e.pdf>
- ³⁹ NHS Action for diabetes <https://www.england.nhs.uk/rightcare/wp-content/uploads/sites/40/2016/08/act-for-diabetes-31-01.pdf>
- ⁴⁰ A Healthier Future – Framework for the Prevention, Early Detection and Early Intervention of type 2 diabetes <https://www.gov.scot/publications/healthier-future-framework-prevention-early-detection-early-intervention-type-2/pages/11/>
- ⁴¹ Recent Advances & Emerging Opportunities <https://www.niddk.nih.gov/about-niddk/strategic-plans-reports/niddk-recent-advances-emerging-opportunities-2018>
- ⁴² Diabetes Epidemic and Action Report <https://www.doh.wa.gov/Portals/1/Documents/Pubs/345-349-DiabetesEpidemicActionReport.pdf>
- ⁴³ Current Status and Response to the Global Obesity Pandemic Proceedings of a Workshop—in Brief <https://www.nap.edu/read/25349/chapter/1#5>
- ⁴⁴ Diabetes Prevention Program Outcomes Study <https://dppos.bsc.gwu.edu/web/dppos/publications>
- ⁴⁵ A Decade Later, Lifestyle Changes or Metformin Still Lower Type 2 Diabetes Risk (press release)
<https://www.nih.gov/news-events/news-releases/decade-later-lifestyle-changes-or-metformin-still-lower-type-2-diabetes-risk>
- ⁴⁶ Long-term effects of lifestyle intervention or metformin on diabetes development and microvascular complications over 15-year follow-up: the Diabetes Prevention Program Outcomes Study
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4623946/>
- ⁴⁷ The cost-effectiveness of diabetes prevention: results from the Diabetes Prevention Program and the Diabetes Prevention Program Outcomes Study <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5471886/>
- ⁴⁸ The Look AHEAD Trial: A Review and Discussion Of Its Outcomes
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4339027/>
- ⁴⁹ Impact of an intensive lifestyle intervention on use and cost of medical services among overweight and obese adults with type 2 diabetes: the action for health in diabetes.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4140155/>
- ⁵⁰ Association of an Intensive Lifestyle Intervention With Remission of Type 2 Diabetes
http://www.infekt.ch/content/uploads/2013/11/jc_mai13_rakic.pdf
- ⁵¹ Cost-Effectiveness of Structured Lifestyle Intervention in Overweight and Obese Adults with Type 2 Diabetes—Results from the Action for Health in Diabetes (Look AHEAD) Study
http://diabetes.diabetesjournals.org/content/67/Supplement_1/171-OR.figures-only
- ⁵² The Finnish Diabetes Prevention Study <http://care.diabetesjournals.org/content/26/12/3230>
- ⁵³ Sustained reduction in the incidence of type 2 diabetes by lifestyle intervention: follow-up of the Finnish Diabetes Prevention Study. <https://www.ncbi.nlm.nih.gov/pubmed/17098085>
- ⁵⁴ NHS Diabetes Prevention Programme (NHS DPP)
<https://preventing-diabetes.co.uk/>

- ⁵⁵ Advancing our health: prevention in the 2020s – consultation document
<https://www.gov.uk/government/consultations/advancing-our-health-prevention-in-the-2020s/advancing-our-health-prevention-in-the-2020s-consultation-document>
- ⁵⁶ A systematic review of real-world diabetes prevention programs: learnings from the last 15 years
<https://implementationscience.biomedcentral.com/articles/10.1186/s13012-015-0354-6>
- ⁵⁷ Rural/urban disparities in access to the National Diabetes Prevention Program
<https://academic.oup.com/tbm/advance-article-abstract/doi/10.1093/tbm/ibz098/5522034?redirectedFrom=fulltext>
- ⁵⁸ Comparing the Lifestyle Interventions for Prediabetes: An Integrated Microsimulation and Population Simulation Model.
<https://www.ncbi.nlm.nih.gov/pubmed/31417128>
- ⁵⁹ Healthy lifestyle and life expectancy free of cancer, cardiovascular disease, and type 2 diabetes: prospective cohort study
<https://www.bmj.com/content/368/bmj.l6669>
- ⁶⁰ Association of an Intensive Lifestyle Intervention With Remission of Type 2 Diabetes
http://www.infekt.ch/content/uploads/2013/11/jc_mai13_rakic.pdf
- ⁶¹ The role of telenursing in the management of diabetes : A systematic review and meta-analysis
<https://onlinelibrary.wiley.com/doi/10.1111/phn.12603>
- ⁶² Team-Based Care to Improve Diabetes Management: A Community Guide Meta-analysis.
<https://www.ncbi.nlm.nih.gov/pubmed/31227069/>
- ⁶³ Effect of incentive payments on chronic disease management and health services use in British Columbia, Canada: Interrupted time series analysis <https://www.sciencedirect.com/science/article/pii/S0168851017303135>
- ⁶⁴ Lifestyle Counseling and Long-term Clinical Outcomes in Patients With Diabetes
<https://care.diabetesjournals.org/content/early/2019/07/05/dc19-0629>
- ⁶⁵ Integrating Chronic Care into Family Practice: Blending the Paradigms
https://clinical.diabetesjournals.org/content/31/1/10?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Clin_Diabetes_TrendMD_0
- ⁶⁶ Supervised lifestyle intervention for people with metabolic syndrome improves outcomes and reduces individual risk factors of metabolic syndrome: A systematic review and meta-analysis.
<https://www.ncbi.nlm.nih.gov/pubmed/31672441>
- ⁶⁷ Revive Lifestyle Medicine
<http://www.revivemedicine.com/revive-reversal-program/>
- ⁶⁸ The cost-effectiveness of diabetes prevention: results from the Diabetes Prevention Program and the Diabetes Prevention Program Outcomes Study <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5471886/>
- ⁶⁹ Cost-Effectiveness of Structured Lifestyle Intervention in Overweight and Obese Adults with Type 2 Diabetes—Results from the Action for Health in Diabetes (Look AHEAD) Study
http://diabetes.diabetesjournals.org/content/67/Supplement_1/171-OR.figures-only
- ⁷⁰ Cost-effective solutions for the prevention of type 2 diabetes
<https://idf.org/component/attachments/?task=download&id=1192>
- ⁷¹ An evidence-based approach to developing low-carbohydrate diets for type 2 diabetes management: A systematic review of interventions and methods.
<https://plus.mcmaster.ca/Obesity/Home/Article/90542>
- ⁷² Effectiveness and Safety of a Novel Care Model for the Management of Type 2 Diabetes at 1 Year: An Open-Label, Non-Randomized, Controlled Study <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6104272/>
- ⁷³ Durability of a primary care-led weight-management intervention for remission of type 2 diabetes: 2-year results of the DiRECT open-label, cluster-randomised trial [https://www.thelancet.com/journals/landia/article/PIIS2213-8587\(19\)30068-3/fulltext](https://www.thelancet.com/journals/landia/article/PIIS2213-8587(19)30068-3/fulltext)
- ⁷⁴ Outcomes of a Digitally Delivered Low-Carbohydrate Type 2 Diabetes Self-Management Program: 1-Year Results of a Single-Arm Longitudinal Study <https://diabetes.jmir.org/2018/3/e12/>

- ⁷⁵ Nutrition Therapy for Adults With Diabetes or Prediabetes: A Consensus Report
<http://care.diabetesjournals.org/content/early/2019/04/10/dci19-0014>
- ⁷⁶ The Food Fix: The role of diet in type 2 diabetes prevention and management
[http://www.parliament.wa.gov.au/parliament/commit.nsf/\(\\$all\)/E65D9AAEA62B2C482583D800295552?opendocument](http://www.parliament.wa.gov.au/parliament/commit.nsf/($all)/E65D9AAEA62B2C482583D800295552?opendocument)
- ⁷⁷ Institute for Personalized Therapeutic Nutrition
<https://www.therapeuticnutrition.org/>
- ⁷⁸ Understanding the mechanisms of reversal of type 2 diabetes
[https://www.thelancet.com/journals/landia/article/PIIS2213-8587\(19\)30076-2/fulltext](https://www.thelancet.com/journals/landia/article/PIIS2213-8587(19)30076-2/fulltext)
- ⁷⁹ Very low calorie diets part of NHS action to tackle growing obesity and Type 2 diabetes epidemic
<https://www.england.nhs.uk/2018/11/very-low-calorie-diets-part-of-nhs-action-to-tackle-growing-obesity-and-type-2-diabetes-epidemic/>
- ⁸⁰ Effectiveness of family-based weight management interventions for children with overweight and obesity
https://journals.lww.com/jbisrir/Abstract/2019/07000/Effectiveness_of_family_based_weight_management.12.aspx
- ⁸¹ Effectiveness of behavioural weight loss interventions delivered in a primary care setting: a systematic review and meta-analysis
<https://www.ncbi.nlm.nih.gov/books/NBK293555/>
- ⁸² The Effect of Telemedicine with Healthcare Provider Feedback on Glycemic Control and Weight Loss in Individuals with Type 2 Diabetes
<https://via.library.depaul.edu/nursing-colloquium/2019/summer/20/>
- ⁸³ Outcomes of a Digital Health Program With Human Coaching for Diabetes Risk Reduction in a Medicare Population
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5944079/>
- ⁸⁴ Reviewing U.S. Connected Diabetes Care: The Newest Member of the Team
<https://www.liebertpub.com/doi/pdf/10.1089/dia.2019.0273>
- ⁸⁵ Glycemic Control for Patients with Type 2 Diabetes: Our Evolving Faith in the Face of Evidence
<https://www.ncbi.nlm.nih.gov/pmc/articles/pmid/27553599/>
- ⁸⁶ The cost-effectiveness of diabetes prevention: results from the Diabetes Prevention Program and the Diabetes Prevention Program Outcomes Study <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5471886/>
- ⁸⁷ Clinical Evidence for the Earlier Initiation of Insulin Therapy in Type 2 Diabetes
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3757533/>
- ⁸⁸ The Case for Diabetes Population Health Improvement: Evidence-Based Programming for Population Outcomes in Diabetes <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5553206/>
- ⁸⁹ Empagliflozin, Cardiovascular Outcomes, and Mortality in Type 2 Diabetes
<https://www.nejm.org/doi/full/10.1056/NEJMoa1504720>
- ⁹⁰ Weight and type 2 diabetes after bariatric surgery: systematic review and meta-analysis
<https://www.ncbi.nlm.nih.gov/pubmed/19272486>
- ⁹¹ Bariatric surgery: an HTA report on the efficacy, safety and cost-effectiveness
https://kce.fgov.be/sites/default/files/atoms/files/KCE_316_Bariatric_surgery_Report.pdf
- ⁹² Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study <https://www.bmj.com/content/352/bmj.h6704>
- ⁹³ Policy lessons from health taxes: a systematic review of empirical studies
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5477308/>
- ⁹⁴ Sugar-Sweetened Beverage Consumption 3 Years After the Berkeley, California, Sugar-Sweetened Beverage Tax
<https://ajph.aphapublications.org/doi/10.2105/AJPH.2019.304971>
- ⁹⁵ The health and economic impact of a tax on sugary drinks in Canada
<https://www.diabetes.ca/getattachment/Newsroom/Latest-News/Will-a-sugary-drinks-levy-benefit-Canadians/The-Health-and-Economic-Impact-of-a-Sugary-Drinks-Tax.pdf.aspx>

- ⁹⁶ Environmental interventions to reduce the consumption of sugar-sweetened beverages and their effects on health
<https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD012292.pub2/full#CD012292-abs-0001>
- ⁹⁷ Evidence Review: Food Security <https://www.health.gov.bc.ca/library/publications/year/2013/food-security-evidence-review.pdf>
- ⁹⁸ Exploring mediators of food insecurity and obesity: a review of recent literature
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3334290/pdf/nihms365575.pdf>
- ⁹⁹ Modelling of the impact of universal added sugar reduction through food reformulation
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5727294/pdf/41598_2017_Article_17417.pdf
- ¹⁰⁰ Restaurant Menu Labeling Policy: Review of Evidence and Controversies
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5124489/pdf/nihms-760391.pdf>
- ¹⁰¹ Nutri-Score: Evidence of the effectiveness of the French front-of-pack nutrition label
https://www.ernaehrungs-umschau.de/fileadmin/Ernaehrungs-Umschau/pdfs/pdf_2017/12_17/EU12_2017_WuF_Nutriscore_englisch.pdf
- ¹⁰² The Effects of Banning Advertising in Junk Food Markets
https://www.bc.edu/content/dam/files/schools/cas_sites/economics/pdf/Seminars/S2015/Dubois.pdf
- ¹⁰³ Obesity risk doubles for teens bombarded with junk food adverts <https://www.cancerresearchuk.org/about-us/cancer-news/press-release/2018-03-15-obesity-risk-doubles-for-teens-bombarded-with-junk-food-adverts>
- ¹⁰⁴ Ending the blame game: The case for a new approach to public health and prevention
<https://www.ippr.org/research/publications/ending-the-blame-game>
- ¹⁰⁵ Association Between Plant-Based Dietary Patterns and Risk of Type 2 Diabetes
https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/2738784?guestAccessKey=58b7f53b-ea0f-4780-90de-e94618af6ff2&utm_source=silverchair&utm_medium=email&utm_campaign=article_alert-jamainternalmedicine&utm_content=etoc&utm_term=072219
- ¹⁰⁶ Association Between Plant-Based Dietary Patterns and Risk of Type 2 Diabetes
<https://jamanetwork.com/journals/jamainternalmedicine/article-abstract/2738784>
- ¹⁰⁷ Where Matters: Health & Economic Impacts of Where We Live
<https://health-design.spph.ubc.ca/where-matters-health-economic-impacts-of-where-we-live-2/>
- ¹⁰⁸ Health effects of the London bicycle sharing system: health impact modelling study
<https://www.bmj.com/content/348/bmj.g425>
- ¹⁰⁹ Cost-effectiveness of population-level physical activity interventions: a systematic review.
<https://www.ncbi.nlm.nih.gov/pubmed/25361461>
- ¹¹⁰ Health impacts of the Cambridgeshire Guided Busway: a natural experimental study.
<https://www.ncbi.nlm.nih.gov/pubmed/26764445>
- ¹¹¹ A systematic review of built environment factors related to physical activity and obesity risk: implications for smart growth urban planning. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3079793/pdf/nihms245519.pdf>
- ¹¹² Walking + Cycling in Vancouver 2017 report card <https://vancouver.ca/files/cov/cycling-report-card-2017.pdf>
- ¹¹³ Moving Matters: Interventions to increase physical activity
<https://www.dc.nihr.ac.uk/themed-reviews/Moving-Matters-FINAL-WEB.pdf>
- ¹¹⁴ Evaluating the Carrot Rewards App, a Population-Level Incentive-Based Intervention Promoting Step Counts Across Two Canadian Provinces: Quasi-Experimental Study <https://mhealth.jmir.org/2018/9/e178/>
- ¹¹⁵ The relationship between changes in steps/day and health outcomes after a pedometer-based physical activity intervention with telephone support in type 2 diabetes patients
<https://academic.oup.com/her/article/28/3/539/761363>
- ¹¹⁶ Using the Internet to Promote Health Behavior Change
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2836773/>
- ¹¹⁷ Social media for health promotion and weight management: a critical debate
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6064151/>
- ¹¹⁸ A web-based self-management programme for people with type 2 diabetes: the HeLP-Diabetes research programme including RCT.

<https://www.ncbi.nlm.nih.gov/pubmed/30199193>

¹¹⁹ The Glycemic Index Concept Uptake and Dietary Assessment in Type 2 Diabetes
https://era.library.ualberta.ca/items/e09226c4-29f3-43d5-b259-80bf1256976e/view/3783d2fb-db70-46dc-9a79-2317b01ac0ce/Avedzi_Hayford_M_201903_PhD.pdf

¹²⁰ Use of mass media campaigns to change health behaviour

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4248563/>

¹²¹ Efficacy of population-wide diabetes and obesity prevention programs

<https://onlinelibrary.wiley.com/doi/abs/10.1111/obr.12821>

¹²² BC Alliance for Healthy Living Society <https://www.bchealthyiving.ca/>

¹²³ BC Food Security Gateway <https://bcfoodsecuritygateway.ca/>

¹²⁴ BC Healthy Communities Society <https://planh.ca/>

¹²⁵ BC Centre for Disease Control <http://www.bccdc.ca/health-professionals/networks/healthy-built-environment-alliance#About-us>

¹²⁶ Cities Changing Diabetes <http://www.citieschangingdiabetes.com/cities/vancouver.html>

¹²⁷ BC Centre for Disease Control <http://www.bccdc.ca/our-services/programs/food-skills-for-families>

¹²⁸ BC Ministry of Health <https://www.healthyfamiliesbc.ca/>

¹²⁹ Pan-Canadian Public Health Network Partners in Public Health <http://www.phn-rsp.ca/index-eng.php>

¹³⁰ BC Children's Hospital <https://www.live5210.ca/about-scope/>

¹³¹ BC Children's Hospital <http://www.bcchildrens.ca/our-services/clinics/shapedown-bc>

¹³² Fraser Health Authority <http://www.ourcommons.ca/Content/Committee/421/HESA/Brief/BR10123638/br-external/BainsDeljitPowerpoint-e.pdf>

¹³³ Abbotsford Division of Family Practice <http://daretotestproject.cf/>

¹³⁴ British Columbia Alliance on Telehealth Policy and Research <http://bcatpr.ca/>

¹³⁵ Pacific Northwest Division of Family Practice <https://www.changebc.net/>

¹³⁶ Child Health BC <https://www.childhealthbc.ca/initiatives>

¹³⁷ Diabetes Canada <https://www.diabetes.ca/>

¹³⁸ Northern Health Authority <https://www.northernhealth.ca/health-topics/diabetes>

¹³⁹ Interior Health Authority

<https://www.interiorhealth.ca/YourCare/ChronicConditionDisease/Pages/Diabetes.aspx>

¹⁴⁰ Fraser Health Authority <https://www.fraserhealth.ca/Service-Directory/Services/chronic-disease-management/diabetes-education#.XE-haFxFKj-g>

¹⁴¹ Vancouver Coastal Health Authority <http://www.vch.ca/public-health/health-topics-a-z/topics/diabetes>

¹⁴² Island Health Authority <https://www.islandhealth.ca/our-locations/diabetes-education-centres>

¹⁴³ BC Ministry of Health <https://www.healthlinkbc.ca/health-topics/center1010>

¹⁴⁴ Institute for Personalized Therapeutic Nutrition <https://www.therapeuticnutrition.org/>

¹⁴⁵ McMaster University <https://nursing.mcmaster.ca/news-events/news/news-item/2018/03/05/new-grant-will-support-research-into-diabetes-self-management-for-seniors>

¹⁴⁶ Medical Weight Management Program <https://www.medweight.ca/>

¹⁴⁷ Revive Lifestyle Medicine <http://www.revivemedicine.com/>

¹⁴⁸ Self-Management BC <http://www.selfmanagementbc.ca/>

¹⁴⁹ Surrey-North Delta Division of Family Practice <https://www.divisionsbc.ca/surrey-north-delta/local-initiatives/diabetes>

¹⁵⁰ BC Centre for Disease Control <http://www.bccdc.ca/health-professionals/data-reports/chronic-disease-dashboard>

¹⁵¹ BC Diabetes Research Network <https://diabetesbc.ca/>

¹⁵² Simon Fraser University <http://www.coheart.ca/>

¹⁵³ Canadian Institutes of Health Research <https://diabetesaction.ca/>

¹⁵⁴ Diabetes BC <https://www.bcdiabetes.ca/>

¹⁵⁵ Simon Fraser University <http://livwellresearch.ca/>

¹⁵⁶ Canadian Institutes of Health Research <http://www.cihr-irsc.gc.ca/e/13521.html>

¹⁵⁷ Michael Smith Foundation for Health Research <https://www.msfr.org/>

¹⁵⁸ CHANGE BC <https://www.changebc.net/>