Profiles on Health

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Diabetes mellitus in New Brunswick

Diabetes mellitus is one of the most common chronic diseases in New Brunswick, and its prevalence continues to increase.

Diabetes occurs when the pancreas does not produce enough insulin (a hormone that regulates blood sugar or glucose) or the body cannot effectively use the insulin it produces to change the glucose from consumed food and drinks into energy, ultimately leading to high blood sugar levels (hyperglycemia). It can result in shortened life expectancy and fewer years lived in good health [1,2]. Diabetes is an important indicator of population health and health system performance because of its increasing prevalence, association with preventable measures, and far-reaching consequences [3,4].

There are three main types of diabetes:

- Type 2, where the body makes insulin but cannot use it properly. Nine in 10 people with diabetes have this type. Being 40 or older is an important risk factor for type 2 diabetes, but it is now increasingly appearing in children and youth. Being overweight or obese is another important risk factor. One of the fastest-growing diseases in Canada, type 2 diabetes can be prevented or postponed by making healthy lifestyle choices including dietary change, physical activity and weight management.

- Type 1, where the body makes little or no insulin. This type of diabetes cannot be prevented based on current knowledge, and people living with it depend on daily doses of insulin for survival. It arises most often in children and youth.

- Gestational diabetes, where the body does not properly use insulin during pregnancy. This type of diabetes usually goes away after the baby is born, although women who had gestational diabetes and their children are at increased risk of type 2 diabetes in the future.

Diabetes affects the nerves, blood vessels and various organs. Common long-term complications include heart disease, stroke,

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- Relative burden of diabetes in New Brunswick.
- Obesity and other contributing factors to diabetes.
- Looking ahead.

kidney failure, vision loss, oral disease, sexual dysfunction and leg or foot amputation (due to nerve damage and poor blood circulation). Conditions associated with type 2 diabetes, mainly through their association with similar risk factors, include arthritis, sleep and breathing

A person with diabetes checks her blood glucose level as part of a personal care plan.
Image courtesy Centers for Disease Control and Prevention

Key Points

- Diabetes is a chronic condition characterized by hyperglycemia (high blood glucose) resulting from the body's inability to use blood glucose for energy. It is a complex disorder, associated with multiple genetic, lifestyle, social and environmental factors. The lifelong duration of types 1 and 2 diabetes can lead to other health complications, including problems with the heart, kidneys, nerves and eyes.
- The diabetes and obesity epidemics, combined with longer life spans, have increased the prevalence of diabetes to one in 10 New Brunswickers. Each year an average of 5,620 residents are diagnosed with type 1 or type 2 diabetes. Many more have not yet been diagnosed but are at high risk of the disease.
- Population aging is the most important demographic change affecting diabetes rates because the occurrence of diabetes increases with age. As with much of Canada, New Brunswick has experienced years of continued growth in diabetes, but there is potential to reverse this trend. People can help lower their chances of type 2 diabetes and its preventable complications by maintaining a healthy weight, exercising regularly, eating a healthy diet, not smoking and keeping their blood glucose in check.
- Socio-economic conditions, such as lower income, are also associated with higher rates of diabetes. Actions to improve rates of diabetes and its underlying determinants at the population level are likely to have a positive impact on other prevalent health conditions.

disorders, depression and some cancers.

Although there is no cure for diabetes, the risk of developing complications can be reduced by managing blood sugar levels through administration of oral medication and/or insulin as well as by lifestyle choices.

The World Health Organization (WHO) estimates the number of adults living with diabetes has almost quadrupled worldwide during the last three decades, largely due to the rise in factors driving type 2 diabetes, including overweight and obesity [2].

In Canada, diabetes is a leading cause of death and diabetes-related costs to the health-care system – such as laboratory tests, physician services and kidney analysis – amount to $15.6 billion annually, or $430 for every man, woman and child [4].

The prevalence of diabetes in New Brunswick has been growing steadily in recent years [5,6].

Diabetes is widely recognized as an enormous global, national and provincial public health challenge, but there is a potential to reverse this trend.

Levels and trends of diabetes

Chronic disease surveillance data indicate the incidence, or new diagnoses, of diabetes has experienced some year-to-year fluctuations during the past decade or so, but has generally increased in New Brunswick (Figure 1). In 2013-14, there were 5,620 new cases of physician-diagnosed diabetes (types 1 and 2 combined), compared to 4,505 in 2001-02. This represents an increase of 25 per cent over 12 years.

Taking into account population growth, the rate of diabetes

incidence rose from 6.2 to 8.1 per 1,000 population between 2001-02 and 2013-14. The rate decreased by about seven per cent in the last two years, but it is too early to consider the implications of such small decreases at this point.

As more people are being diagnosed and are living longer with diabetes, the prevalence (or total number of cases) continues to increase.

One in 10 New Brunswickers has diabetes

In 2007-08, one in 13 New Brunswickers one year and older was living with diagnosed diabetes, and it was projected that the ratio would rise to one in 10 in five years [5].

New data confirm that one in 10 New Brunswickers one year and older (74,740 individuals) now has this lifelong condition (Figure 2).
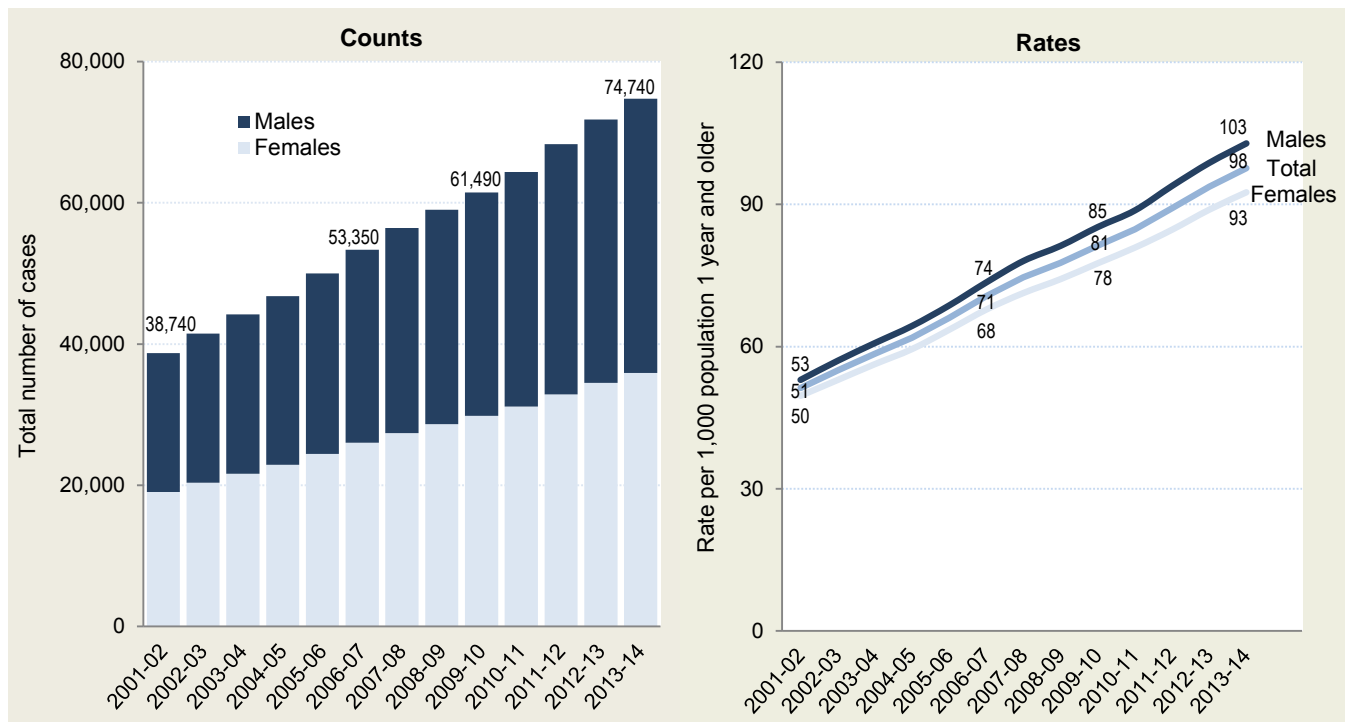
Figure 1: Trends in the incidence of diagnosed diabetes, by gender, New Brunswick, 2001-02 to 2013-14
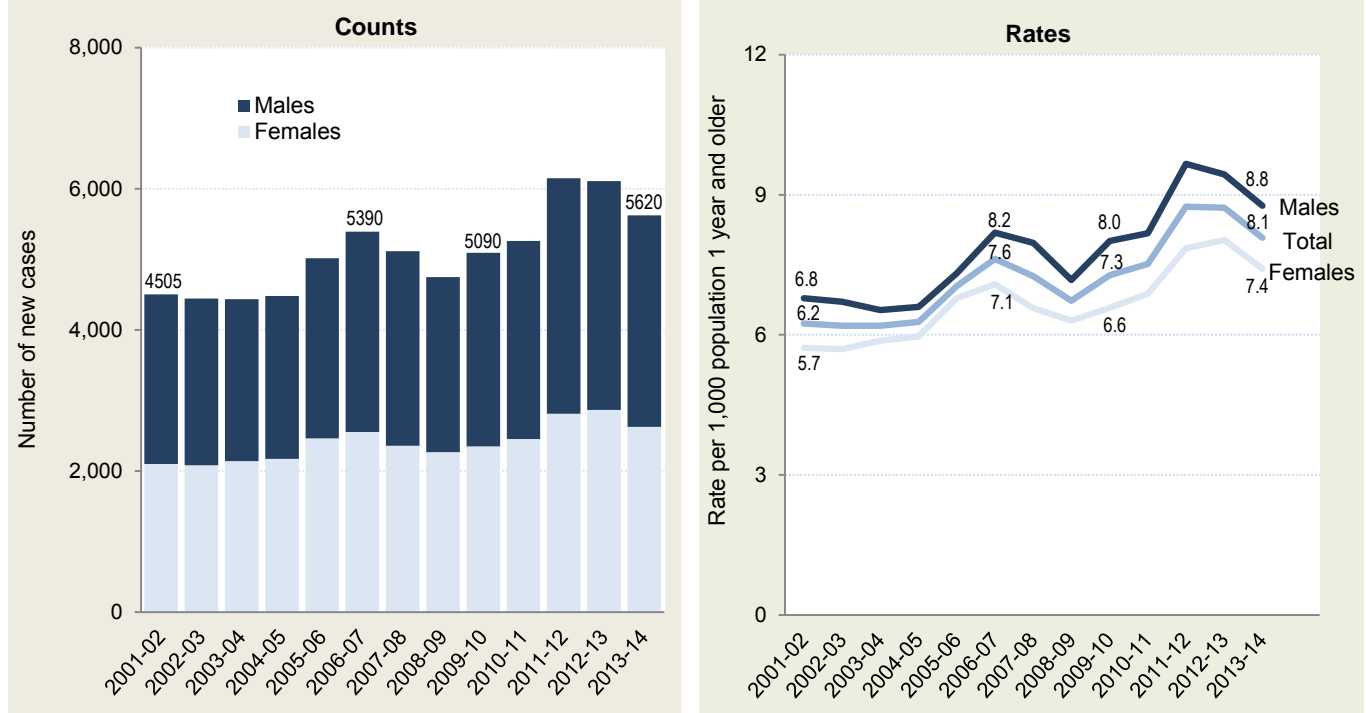
Note: Data on physician-diagnosed diabetes mellitus (types 1 and 2 combined) among New Brunswick residents one year and older based on tracking of individuals' interactions with the healthcare system integrating various health administrative databases.
Source: New Brunswick Department of Health, using the Canadian Chronic Disease Surveillance System infrastructure and case definitions.

Figure 2: Trends in the prevalence of diagnosed diabetes, by gender, New Brunswick, 2001-02 to 2013-14

Note: Data on physician-diagnosed diabetes mellitus (types 1 and 2 combined) among New Brunswick residents one year and older based on tracking of individuals' interactions with the healthcare system integrating various health administrative databases.
Source: New Brunswick Department of Health, using the Canadian Chronic Disease Surveillance System infrastructure and case definitions.

This represents a 25-per-cent increase in the numbers from five years earlier, and a 90-per-cent increase compared to 12 years earlier.

Diabetes prevalence increases substantially with advancing age

Because diabetes is a chronic disease, the proportion of people with diagnosed diabetes tends to increases with age. The sharpest increase occurs after 40 years, as the body's ability to produce and use insulin begins to deteriorate.

Between 2002-03 and 2013-14, the greatest increase in prevalence was seen among persons 65 and older

(Figure 3). One in four seniors now has the disease (270 per 1,000 population), compared to fewer than one in five 12 years earlier (190 per 1,000 population).

While prevalence increases with age, one-half (48 per cent) of New Brunswickers living with diabetes are of working age, between 20 and 64 years of age.

Slightly increasing diabetes prevalence is observed in the youngest age groups. In 2013-14, 640 New Brunswickers 1 to 19 years old were living with diabetes (4.4 per 1,000), up from 550 in 2002-03 (3.2 per 1,000) (Figure 4).

One of the challenges with the provincial data sources for surveillance of diabetes is the inability to identify whether persons have type 1 or type 2 diabetes. It is reasonable to assume, at least for now, that the vast majority of children and youth are diagnosed with type 1 diabetes.

Canada has higher rates of type 1 diabetes in children than most other countries with developed market economies [7]. While type 1 accounts for only some 10 per cent of all diabetes cases, incidence rates are rising fast in some countries, possibly attributable to changing environments and infant and maternal diets [7].

Figure 3: Trends in the prevalence of diabetes by age group, New Brunswick, 2002-03 to 2013-14
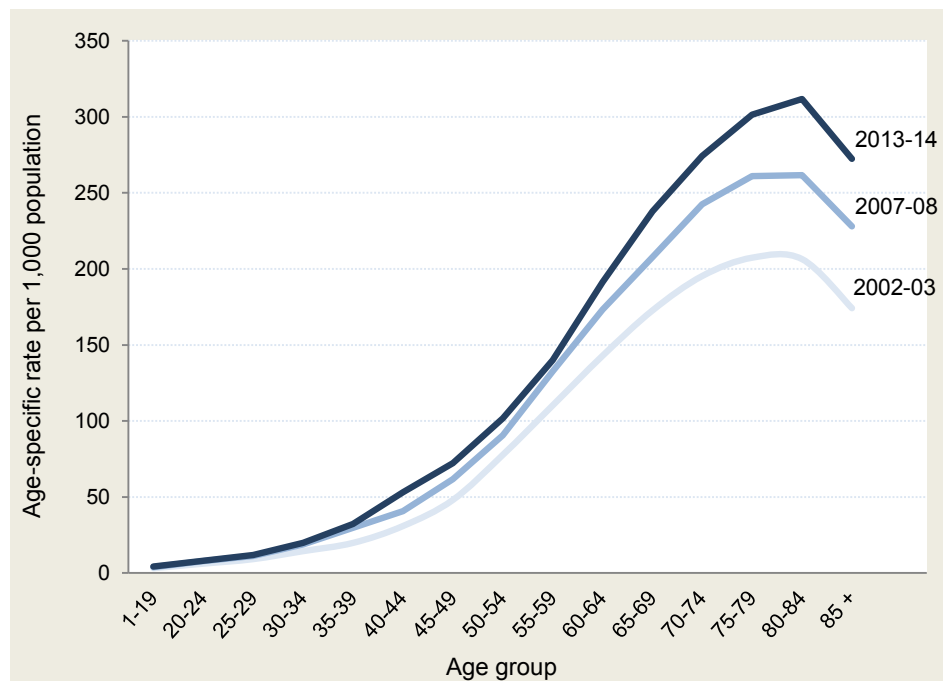
An estimated **1** in **10** New Brunswickers has been diagnosed with diabetes.

The disease is more common in older age groups. Among those 65 and older, **1** in **4** has diabetes.

Note: Data on diagnosed diabetes mellitus (types 1 and 2 combined) among New Brunswick residents one year and older.
Source: New Brunswick Department of Health, using the Canadian Chronic Disease Surveillance System infrastructure and case definitions.

Figure 4: Trends in the prevalence of diabetes among children and youth under 20, New Brunswick, 2002-03 to 2013-14
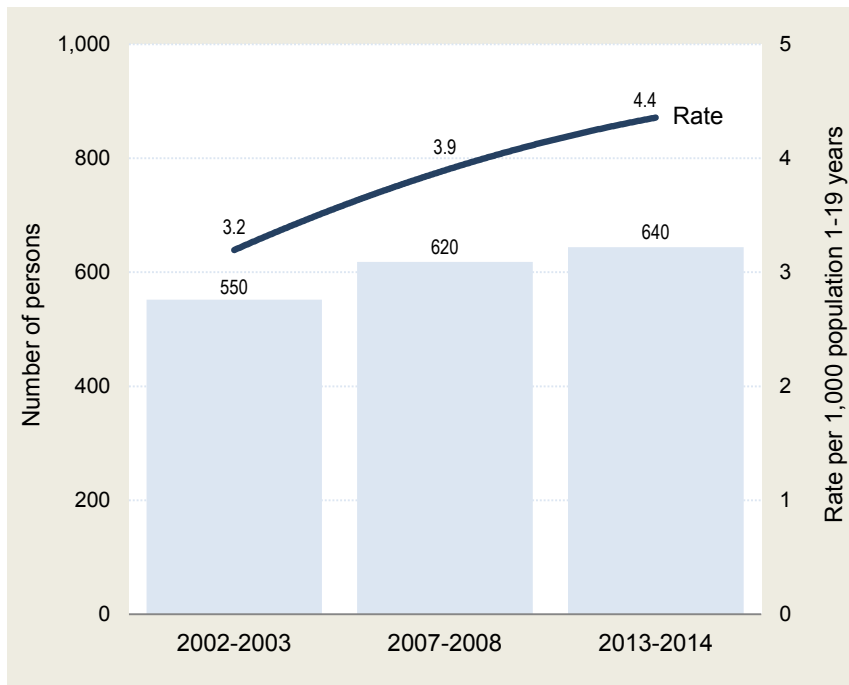
Note: Data on diagnosed diabetes mellitus among New Brunswick residents one to 19 years.
Source: New Brunswick Department of Health, using the Canadian Chronic Disease Surveillance System infrastructure and case definitions.

Men overall have higher rates of diabetes than women

While women generally live longer, diabetes is more common among men. The incidence rate of diabetes (types 1 and 2) is some 15 per cent higher among New Brunswick males compared to females (8.8 versus 7.4 per 1,000 population in 2013-14), a pattern that has remained relatively stable (Figure 1).

Given the years of higher diabetes incidence among males, considerably more males are now living with the condition than females (103 versus 93 per 1,000 population in 2013-14). The gender gap in diabetes prevalence is growing over time (Figure 2).

Male excess in diabetes has been found in many populations with higher type 2 incidence, possibly due to sex-related differences in insulin sensitivity, consequences of obesity and regional body fat deposition, and other contributing factors such as high blood pressure, tobacco smoking and alcohol intake [8,9].

This does not include gestational diabetes, a type of diabetes that develops only in pregnant women. Gestational diabetes is

detected in three to five per cent of pregnancies [1,5]. Its occurrence increases with age.

In pregnancy, diabetes is associated with health risks for both the mother (complications in labour and delivery) and the fetus (high birth weight and congenital anomalies leading to increased risk of death).

Although gestational diabetes is a temporary condition, about 20 per cent of women 20 to 39 years when first diagnosed with gestational diabetes will develop type 2 diabetes within nine years [5].

Blood tests identify increasing numbers of hyperglycemic conditions

Many long-term complications of diabetes are linked to sustained high blood glucose causing damage to the blood vessels in the body, which in turn affects the heart, kidneys, eyes, nerves and feet. Clinical tests for hyperglycemia identify individuals who have, or are at risk of, diabetes and its preventable complications. Since diabetes develops over time, different or repeat tests are typically used to tell when overall blood glucose levels are becoming too high.

Laboratory measurement of glycosylated hemoglobin (also known as A1c testing), as an indicator of the degree of control of glucose metabolism, helps to diagnose, prevent and manage type 2 diabetes [2,10]. The higher the A1c level, the higher the

average concentration of glucose in the blood during the preceding three months, and the higher the risk of diabetes complications. An A1c level below 5.7 per cent is generally considered in the healthy range.

Other blood glucose measurements (fasting plasma glucose, random plasma glucose and oral glucose tolerance tests) are also used to diagnose and manage types 1 and 2 and gestational diabetes, in conjunction with a review of risk factors and symptoms. There is increasing evidence A1c is a better predictor of

future chronic complications associated with diabetic glycemic levels in the general population [11].

Increasing numbers of persons with poor blood sugar control have been identified in New Brunswick since the introduction of A1c testing in 2000 (Figure 5).

In 2015-16, 46,875 New Brunswickers (63 per 1,000 population one year and older) were detected to have had elevated glucose concentrations (A1c value of 6.5 per cent or higher), putting

them at substantial risk of diabetes complications such as heart disease and eye disease (diabetic retinopathy), regardless of diagnosis status. Of these, more than 10 per cent had severe hyperglycemia (A1c value of 9.0 per cent or higher).

Another 51,210 individuals (69 per 1,000 population one year and older) had recorded A1c levels between 6.0 and 6.4 per cent; i.e., impaired glucose tolerance among those who have not yet been diagnosed with diabetes, also referred to

Figure 5: Trends in the population with increased A1c values classified at risk of diabetes and its preventable complications, New Brunswick, 2005-06 to 2015-16
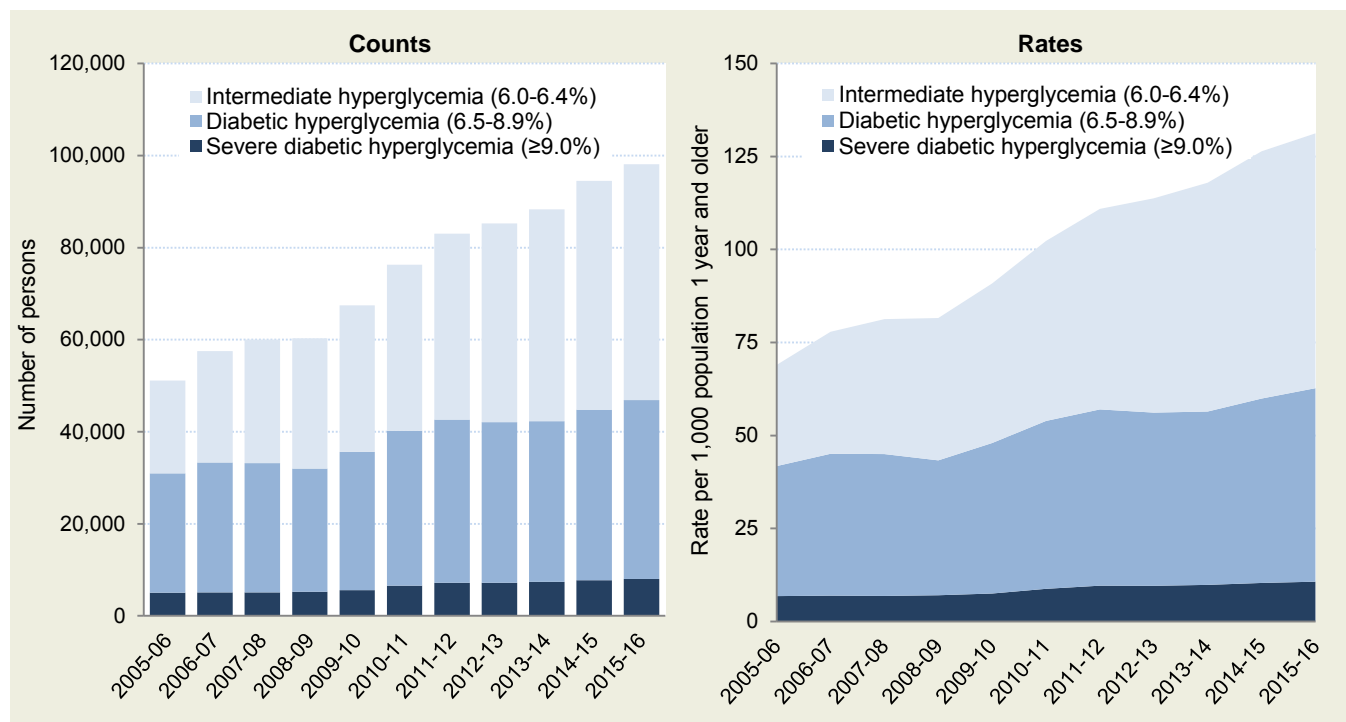
Note: Data on average blood glucose levels as measured in a hemoglobin A1c test, regardless of diagnosis status. An A1c result of 6.5 per cent or greater indicates elevated blood glucose associated with diabetes and its complications (although diagnosis in a clinical setting necessitates confirmation with a second measurement unless there are clear symptoms of diabetes and in consideration of certain conditions known to interfere with test results). A result of 9.0 per cent or greater indicates severe diabetic hyperglycemia detected in the reporting period. A result between 6.0 and 6.4 per cent indicates controlled diabetic glycemic levels, or prediabetes in the absence of previous diagnosis. Glycemic targets for diabetes management should be individualized based on age and other patient characteristics, and balanced against risk of inducing hypoglycemia.
Source: New Brunswick Department of Health, using the regional health authorities' A1c/LDL lab services databases.

as prediabetes. Prediabetes, which usually has no symptoms, increases the risk of type 2 diabetes heart disease and stroke – although this can be prevented or delayed by diet, exercise and weight loss.

The cumulative number of persons with metabolic markers for diabetes and prediabetes (98,085) is twice that observed 10 years earlier, attributable in large part to more widespread A1c testing in the province. This number excludes those who have been diagnosed with diabetes but have not had an A1c test as part of their care plan for reducing the risk of complications. National data suggest 20 per cent of adults with diabetes do not receive A1c tests annually [12].

Laboratory-based data do not include results from self-monitoring of blood glucose, i.e., when persons with diabetes collect information about their glucose levels at various time points using home blood glucose meters. Depending on the patient population, self-testing may be associated with improvements in glycemic control [13]. Self-monitoring of blood glucose can also serve for other measures of glycemia,

notably hypoglycemia, a potentially life-threatening emergency that can arise when glycemic levels are too low [10].

Relative burden of diabetes in New Brunswick

Because diabetes is strongly related to age, provinces and territories with disproportionately older populations are expected to have higher diabetes rates.

New Brunswick's population is older than the national average: (20 versus 17 per cent 65 years of age and older) [14], so New Brunswick's crude (unadjusted) diabetes rate is expected to be higher. The proportion of seniors is growing faster than any other age group, a result of longer life expectancy, declining fertility rates and aging of the baby boom cohort, exacerbated in New Brunswick by negative interprovincial migration [15].

Higher diabetes rates in New Brunswick are associated with population aging

National chronic disease surveillance data show the crude incidence rate of

diagnosed diabetes (types 1 and 2) has been significantly higher in New Brunswick than the Canadian average, but the gap is essentially attributable to differences in the population age structure (Figure 6) [16].

After adjusting for differences in age distribution among the provinces and territories, the diabetes incidence rate in New Brunswick has been similar to the Canadian average in recent years (no significant difference in 2008-09 and 2009-10) (Figure 6) [16].

When population aging is taken into account, the increase in New Brunswick's diabetes prevalence rate between 2007-08 and 2013-14 was 15 per cent, or one-half as quickly as the 25-per-cent increase observed in the crude rate.

The diabetes prevalence rate, influenced by the incidence and by the duration of the condition, has nonetheless remained significantly higher in New Brunswick compared to nationally during the previous decade (Figure 7). The province's higher diabetes prevalence is largely a reflection of an older population and of significantly higher

For more information on diabetes prevention and management, New Brunswickers may access the following resources:

- In person: speak to a health-care provider
- Telephone: Tele-Care at 811 (24 hours a day)
- Web: Government of New Brunswick, *A Comprehensive Diabetes Strategy for New Brunswickers* (www.gnb.ca/0053/phc/diabetes-e.asp)
- Web: Government of Canada – Public Health Agency of Canada (www.phac-aspc.gc.ca/cd-mc/diabetes-diabete)

disease incidence 10 years earlier.

Data from the Canadian Community Health Survey (CCHS) on self-reported diabetes status confirm the pattern of higher crude prevalence rate in New Brunswick compared to the national average (8.4 per cent versus 6.7 per cent of the population 12 and older in 2014), and higher than in seven other provinces (except in Newfoundland and Labrador and in Nova Scotia) [17].

The survey data also indicate no significant difference in the age-adjusted diabetes rates between New Brunswick and the Canadian average in recent years (similar annual rates from 2012 to 2014) [18].

In addition to demographic changes, clinical and lifestyle factors may influence trends in diabetes incidence and prevalence observed through surveillance data.

Growing awareness among health-care professionals and the public combined with broader diagnostic criteria could lead to increased detection of diabetes cases identified. For example, changes in the recommendations for type 2 diabetes screening and localized screening campaigns may influence observed rates across each province and territory [1].

Figure 6: Trends in diabetes incidence rates, New Brunswick and Canada, 2001-02 to 2013-14
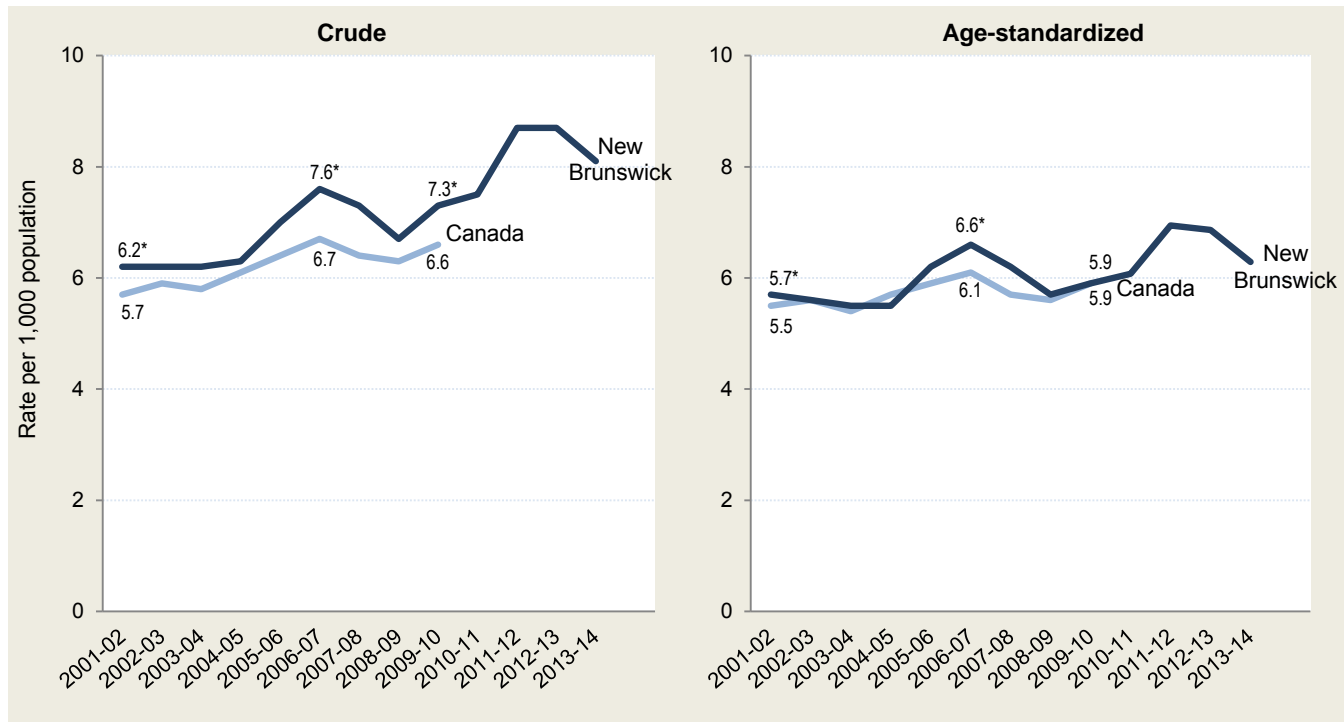
Note: * = statistically different from the national rate (p<0.05). Data on diagnosed diabetes mellitus (types 1 and 2 combined) using population-based health administrative databases. Age standardized rates are adjusted against the 1991 Canadian Census population structure to allow for meaningful comparisons across population groups and over time.
Source: New Brunswick Department of Health and Public Health Agency of Canada, using data from the Canadian Chronic Disease Surveillance System.
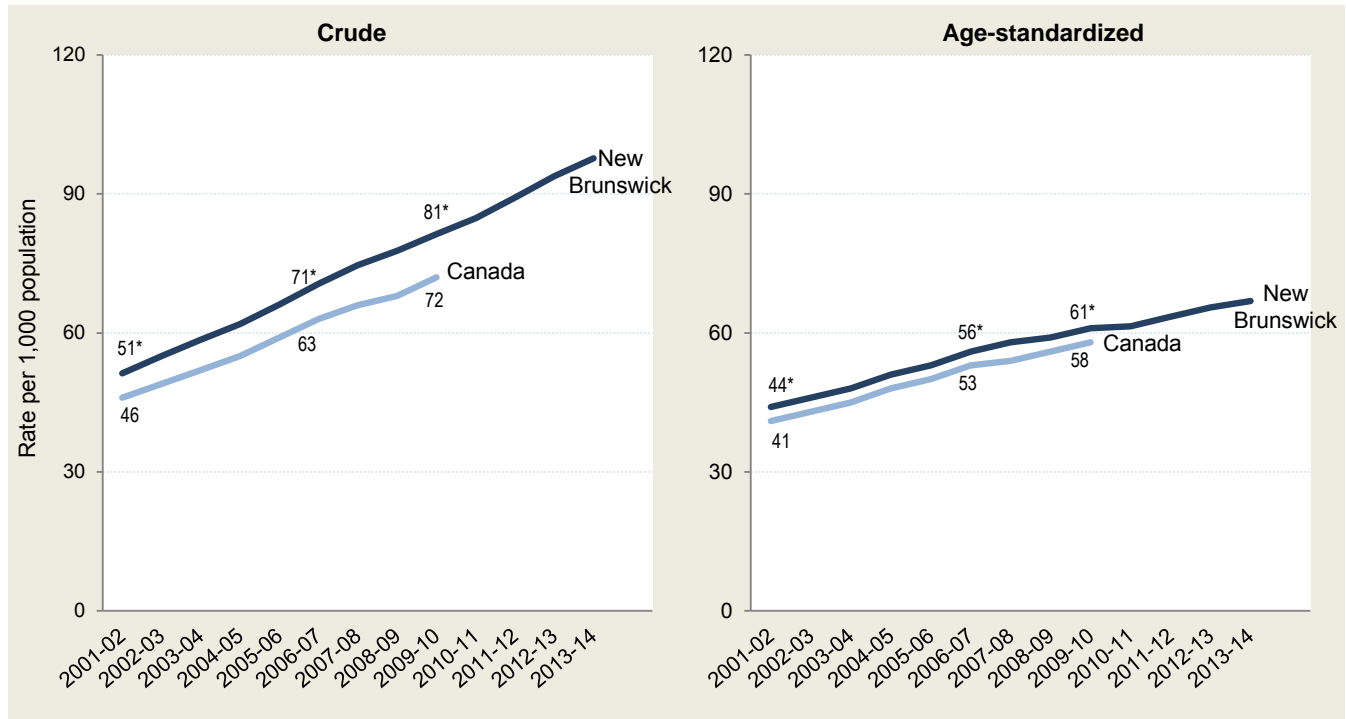
Figure 7: Trends in diabetes prevalence rates, New Brunswick and Canada, 2001-02 to 2013-14

Note: * = statistically different from the national rate (p<0.05). Data on diagnosed diabetes mellitus (types 1 and 2 combined) using population-based health administrative databases. Age standardized rates are adjusted against the 1991 Canadian Census population structure to allow for meaningful comparisons across population groups and over time.
Source: New Brunswick Department of Health and Public Health Agency of Canada, using data from the Canadian Chronic Disease Surveillance System.

International data indicate diabetes prevalence among adults, as measured by raised fasting blood glucose, is lower in Canada (age-standardized rates of 48 per 1,000 females and 62 per 1,000 males) compared to the regional average for the Americas (81 per 1,000 females and 85 per 1,000 males) [19]. This may be related to reductions in smoking and better management of diabetes compared to many low- and middle-income countries in the region.

Deaths from diabetes are declining, but often go underreported

Diabetes is the sixth leading cause of death in Canada and New Brunswick [20], and the eighth worldwide [2]. It was the direct cause of 215 deaths among New Brunswickers in 2014 – slightly more men than women (111 versus 104) – representing 3.2 per cent of all deaths in the province [21].

While the numbers have fluctuated from year to year, generally speaking the mortality burden of diabetes has declined in New Brunswick during the last decade, down from a peak rate of 3.6 deaths per 10,000

population in 2005 to 2.8 per 10,000 in 2014 (Figure 8) [21,22]. This is likely due to better and earlier treatment of the disease, given that the prevalence of diabetes continues to increase [4].

New Brunswick's diabetes mortality rate is higher than the Canadian average, but the gap narrows considerably when taking into account the province's older demographics (Figure 8) [22].

Looking at data on diabetes as the cause of death may obscure the true burden of this disease. Diabetes is not itself usually reported as cause of death, but

Figure 8: Trends in mortality rates due to diabetes, New Brunswick and Canada, 2002 to 2014
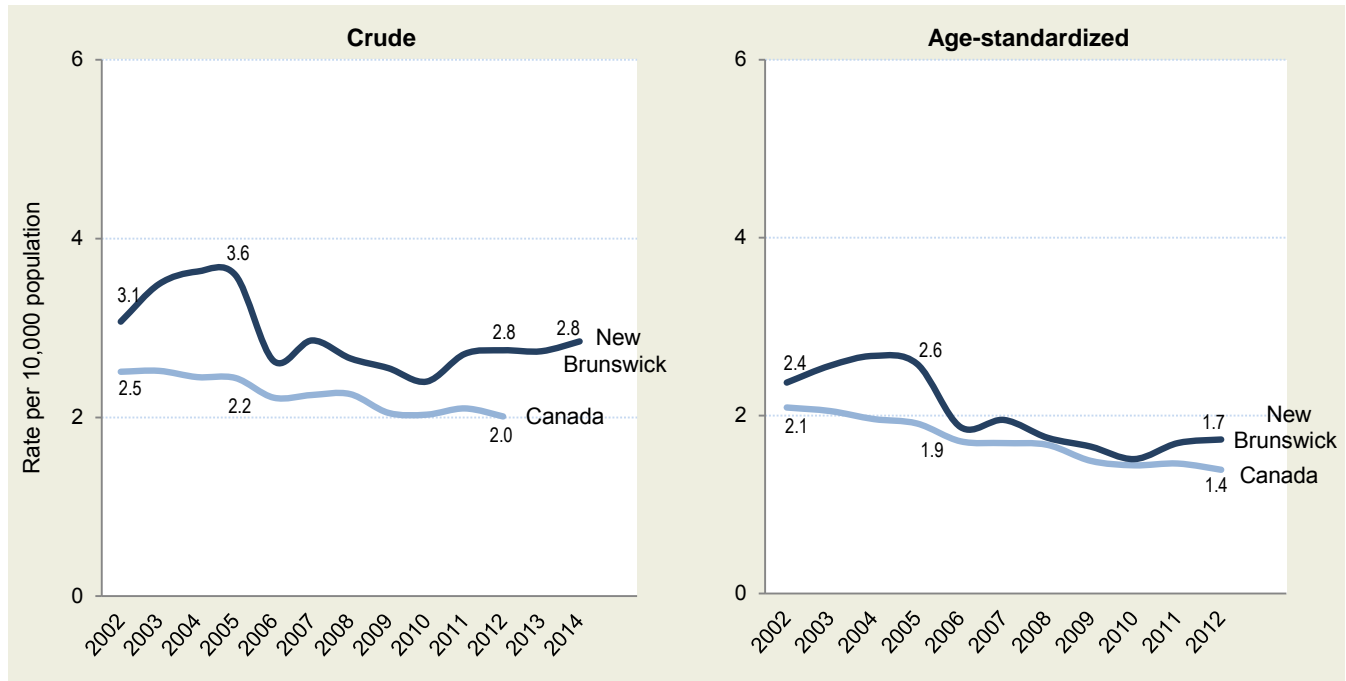
Note: Data on underlying cause of death among New Brunswick residents tabulated according to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision*: ICD-10 codes E10-E14 (diabetes mellitus, types 1 and 2 combined). The underlying cause of death is defined as the disease or injury which initiated the train of events leading directly to death, as listed on the medical certificate of cause of death.
Source: Statistics Canada and Service New Brunswick, Vital Statistics.

many of its complications (e.g., heart disease, stroke, kidney disease) are associated with premature death and are often listed as the underlying cause on death certificates rather than diabetes [1].

Globally, WHO estimates diabetes causes 1.5 million deaths each year, with another 2.2 million deaths attributable to high blood glucose resulting in increased risks of cardiovascular and other diseases [2].

Contributing factors to diabetes

A number of lifestyle, genetic, social, economic and environmental factors have important effects on the levels and patterns of diabetes in the population.

The risk factors for type 1 diabetes are still not well understood but studies suggest genetic factors and environmental triggers are involved. There is no conclusive evidence for interventions to prevent or delay the onset of type 1 diabetes.

The key risk factors for type 2 diabetes are well known [2,10]. Some of these factors – such

as age, genetics and ethnicity – are not modifiable. Others, such as being overweight or obese, unhealthy diet, insufficient physical activity and smoking, are modifiable through behavioural and environmental changes. Risk factors of developing gestational diabetes are similar.

Since type 2 is the most common type of diabetes, assessing the risk factors for type 2 diabetes is critical to informing clinical and public health-care strategies for reducing problems associated with this disease.

Increasing rates of overweight and obesity linked to rising diabetes

The causes of diabetes are complex. While its development cannot be explained by any single factor, overweight and obesity are the strongest risk exposures linked to rising diabetes prevalence worldwide [2]. About 80 to 90 per cent of people with type 2 diabetes are overweight or obese [10]. In Canada, adults who are obese are nearly three times more likely than those who are not obese to report that they had been diagnosed with diabetes (14.6 versus 5.2 per cent in 2014) [23].

The most widely used indicator to assess the health risks of overweight and obesity in a population is based on body mass index (BMI), a measure that examines weight in relation to height [24,25].

Based on the CCHS, nearly two-thirds of New Brunswickers 18 and older, roughly 355,960 adults, report height and weight that classify them as overweight or obese (Figure 9) [17]. The rate is considerably higher among men than women (70 versus 58 per cent in 2014) [17].

The provincial rate of adult overweight and obesity

increased by 12 per cent between 2003 and 2014. It is significantly higher than the national average (64 versus 54 per cent in 2014) [17]. The pattern holds when controlling for differences in population age structure (age-standardized rate of 61 versus 52 per cent in 2014) [18].

The rate of overweight and obesity among children and youth 12 to 17 years old has decreased somewhat since 2005 and remained relatively stable in New Brunswick in recent years (Figure 9). The provincial rate is no longer statistically different from the national average [17].

Figure 9: Trends in the rate of overweight and obesity among adults and youth, New Brunswick and Canada, 2005 to 2014
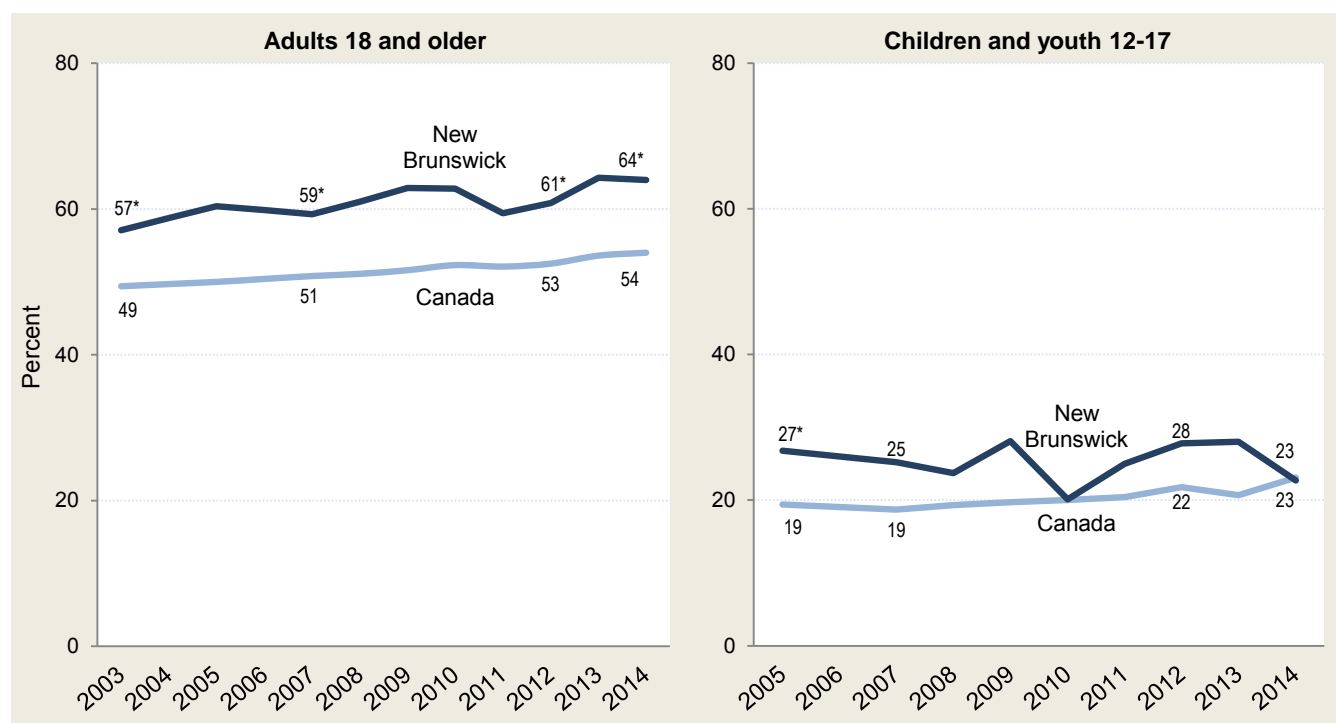
Note: * = statistically different from the national rate (p<0.05). Data based on self-reported height and weight and classified according to health risk using internationally accepted cut-off points for body mass index (excluding pregnant women).
Source: Statistics Canada, Canadian Community Health Survey.

Still, nearly one-quarter of youth in the province – some 10,630 boys and girls – are at greater risk of type 2 diabetes and other chronic conditions in the future associated with having excess weight in childhood.

International data indicate the prevalence of overweight and obesity among adults and among children are among the highest in Canada compared to other countries with developed market economies [26].

Overweight and obesity results when people consume far more calories than they use. This imbalance has been attributed to a variety of changes in society, work and leisure have affected activity and eating patterns, such as a shift toward less physically demanding work, increased use of automated transport, passive leisure activities and increased intake of foods that are high energy-dense but nutrient-poor (often high in sugar and saturated fats).

Social inequalities contribute to diabetes

There is growing evidence that the social and cultural conditions in which people are born, grow and age are important determinants of health. Obesity prevention can reduce a large proportion of the diabetes burden, notably by acting on the underlying determinants that contribute to obesogenic environments.

Socio-demographic factors, including lower income, belonging to certain ethnic groups and living in rural areas, are generally associated with higher rates of type 2 diabetes [1].

New Brunswickers living in lower income households are significantly more likely to report having been diagnosed with diabetes than those living in higher-income households (Figure 10) [27].

Concurrently, levels of unhealthy eating and physical inactivity – which are fuelling the obesity epidemic – are significantly higher in lower-income households.

The rate of unhealthy eating, as assessed through inadequate daily consumption of vegetables and fruits, is highest among persons in the least affluent households compared to the most affluent households (73 versus 62 per cent). This pattern is attributed in part to differences in gaining access to health literacy, food security and other societal resources.

Physical activity is important for both diabetes prevention and management, inhibiting the progression of the disease by increasing sensitivity to insulin. In New Brunswick, the rate of physical inactivity during leisure-time drops from 57 to 40 per cent across the least to the most affluent group.

Tobacco smoking is also associated with an increased risk of type 2 diabetes and its complications, particularly cardiovascular disease. While smoking rates have been declining in New Brunswick over the last several years, they remain twice as high among those in the lowest versus highest household income group (Figure 10) [27].

Some communities may be more vulnerable to adverse health outcomes. While current data are unable to distinguish the relative risk related to First Nations identity in developing diabetes in New Brunswick, national data indicate diabetes prevalence is three to five times higher among Aboriginal populations compared to the non-Aboriginal average [1]. This pattern can be attributed to their socio-economic disadvantage compared to the rest of the population.

It is estimated that if all New Brunswickers experienced the same diabetes prevalence rate as those in the highest income level, there would be one-quarter (24 per cent) fewer persons living with diabetes across the province [28].

If all New Brunswickers had the same low diabetes rate as those in the highest income level, there would be about 1 in 4 fewer cases of diabetes.

Figure 10: Rates of self-reported diabetes and modifiable risk factors by household income group, New Brunswick
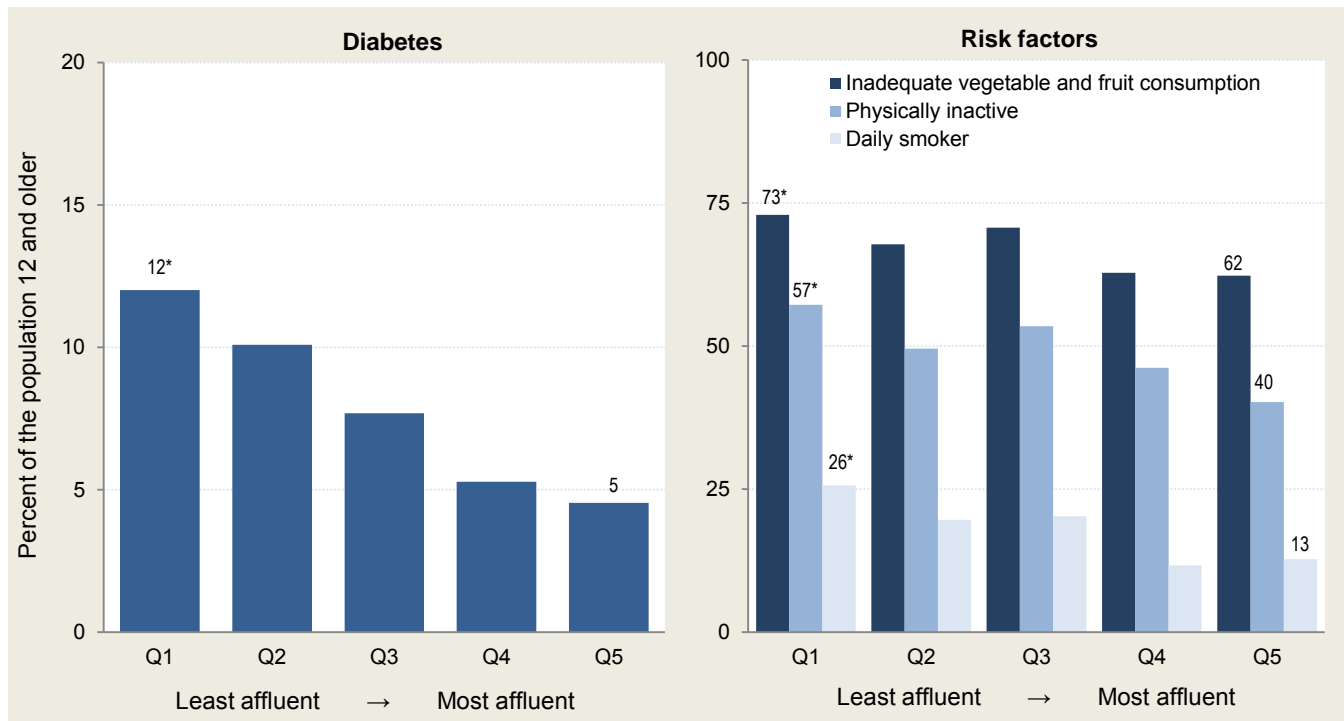
Note: * = statistically different from the Q5 rate (p<0.05). Household income groups based on income quintiles adjusted to the household and community size, with quintile 1 (Q1) representing the least affluent households and quintile 5 (Q5) the most affluent. Data on diabetes based on self-reports of having been diagnosed by a health professional with type 1 or type 2 diabetes, or gestational diabetes among females 15 and older. Inadequate vegetable and fruit consumption indicates the person reports usually eating vegetables and fruits fewer than five times per day. Physically inactive based on an index of average daily physical activity during leisure time. Daily smoker indicates the person reports currently smoking cigarettes every day.

Source: New Brunswick Department of Health, using data from the Canadian Community Health Survey 2011-2012 (two-year period estimates).

Inequalities by income are also reflected in diabetes management. The Canadian Diabetes Association estimates people with diabetes average over $1,500 in out-of-pocket expenses for medications, devices and supplies needed for self-managing their disease, leaving many lower income Canadians with diabetes at risk of not being able to comply with their prescribed therapy due to costs [29].

Looking ahead

Diabetes mellitus is one of the most common and rapidly increasing chronic conditions in Canada and New Brunswick. One in 10 New Brunswickers one year and older is living with diagnosed diabetes, mostly type 2. Many more individuals may not yet have been diagnosed.

Diabetes exerts important impacts on physical, mental and social health. Nearly two-fifths (39 per cent) of Canadian adults who report having diabetes rate their health as "fair" or "poor," compared to one-tenth of the adult population without diabetes (10 per cent) [1].

Diabetes prevalence is likely to continue to increase in the near future

The aging of the population has been one of the main factors contributing to the increase in the number of New Brunswickers with diabetes. Taking into account shifts in the population age structure, the incidence rate of diabetes has remained relatively stable, although prevalence has been steadily increasing given the greater longevity of individuals living with the disease (due to advancements in clinical and preventive care).

As the population ages, the number of New Brunswickers living with diabetes is likely to continue to increase in the near future [4]. While the diabetes prevalence rate has been higher in New Brunswick compared to the national average, given the contracted incidence gap, it is uncertain whether the pattern of higher prevalence in the province will prevail in the longer term.

Other contributors to the increase in the number of cases of diabetes are rising rates of overweight and obesity, increasingly sedentary lifestyles and the global nutrition transition.

Reducing diabetes would positively affect other chronic diseases

People with diabetes often have additional serious health problems, known as comorbid conditions.

Canadians and New Brunswickers with diabetes are twice as likely to be hospitalized with a stroke than individuals without diabetes, and two to four times more likely to be hospitalized with heart disease

[1,5]. Those with diabetes are hospitalized three to four times more often with a heart attack, eight to 12 times more often with renal failure, and 12 to 20 more often with a lower limb amputation.

It has been estimated that if diabetes was eliminated from the population, the rate of heart attacks would decrease by 19 per cent among women and by 10 per cent among men worldwide [30].

Keeping type 2 diabetes from occurring in the first place, and preventing the complications and premature deaths that can result from all types of diabetes, are critical to reducing the problems associated with this disease. Reducing the burden of diabetes will also likely have a positive impact on other chronic diseases.

Evidence-based actions to prevent and manage diabetes have the potential to reverse current trends

For those with diabetes, early diagnosis can help improve health outcomes. Living well with diabetes means blood glucose control, through a

A male with diabetes and a health-care professional talk about managing his disease, including blood sugar monitoring and related factors such as diet and physical activity.
Image courtesy WHO

combination of diet, physical activity, weight management and, if necessary, medication and/or insulin therapy. It also means controlling the risk factors associated with cardiovascular disease (blood pressure and lipids) and regular screening for other common complications (damage to the eyes, kidneys and feet).

Slowing the rise in diabetes has been identified as a global, national and provincial priority [2,31]. Preventive measures including targeted interventions for healthy lifestyle choices among individuals at high risk for type 2 diabetes (e.g., those with prediabetes), as well as population-wide strategies for reducing rates of overweight and obesity and addressing the

For information and resources for individuals, families, health professionals and organizations on healthy body weights, visit:

- *It's your health: Obesity* (Health Canada): hc-sc.gc.ca/hl-vs/iyh-vsv/life-vie/obes-eng.php
- *Childhood Obesity*: www.healthycanadians.gc.ca/healthy-living-vie-saine/obesity-obesite/index-eng.php
- *Our Health Our Future: A national dialogue on healthy weights*: ourhealthourfuture.gc.ca
- *Clinical practice guidelines on the management and prevention of obesity in adults and children* (Canadian Medical Association): www.cmaj.ca/cgi/content/full/176/8/S1/DC1
- *Healthy Eating Physical Activity Coalition of New Brunswick*: hepac.ca

underlying determinants, are likely to have the greatest impact [2,10,32].

Evidence-based approaches to reduce the rates and costs of diabetes include policies and practices across populations and within specific settings (schools, homes, workplaces, health-care settings, during times of leisure, etc.) that contribute to good health for everyone, regardless of whether they have diabetes, such as exercising regularly, eating healthily and avoiding smoking [2,10].

No single policy or intervention can ensure this happens. A range of policies, legislation and changes to the environment are needed to address systematically the factors that influence health risks and outcomes at the necessary scale, including removing barriers to healthy lifestyles for those living in poverty.

Twenty years from now, in 2036, 30 per cent of New Brunswickers will be 65 or older [15] and at high risk for type 2 diabetes. Despite some limited data that the incidence of diabetes may be plateauing, diabetes prevalence remains high and continues to increase.

Investing in supportive built and social environments to mitigate the risks of overweight and obesity during the life-course, beginning in childhood when eating and physical activity habits are formed and when the long-term regulation of energy

balance may be programmed, is an investment in the health of New Brunswickers. Everyone has a role to play to collectively reduce the impact of all forms of diabetes.

An aging population and an important rise in obesity place New Brunswickers at increased risk of developing diabetes. One in 10 New Brunswickers has diabetes, and about 5,600 new cases are diagnosed annually.

New Brunswick's *Comprehensive Diabetes Strategy* outlines the province's road map to address the growing challenge of diabetes. This includes improved prevention, screening, health coaching, access to affordable medications and supplies, and support for the management of diabetes and its risk factors.

Read more at: www.gnb.ca/0053/phc/diabetes-e.asp

About the data

Measures of incidence and prevalence of diabetes mellitus in New Brunswick were calculated using diagnostic information from the provincial physician billing and hospital discharge abstract databases drawing on Canadian Chronic Disease Surveillance System (CCDSS) infrastructure, privacy protocols and case definitions [33]. New Brunswick has a universal single-payer health-care system that covers all physician and hospital services for residents. Full-time members of the Canadian Forces and people in federal correctional facilities are not included in the provincial databases.

The CCDSS identifies people with diagnosed diabetes using an algorithm validated through a collaborative network supported by the Public Health Agency of Canada (PHAC). Information from the discharge abstract database includes clinical diagnoses for acute-care hospital stays, coded using the *International Classification of Diseases and Related Health Conditions* (ICD-10-CA). Data from the physician billing database are based on search patterns for "diabetes" and related nomenclature, including all fee-for-service payments for services rendered as well as alternate payment structures using shadow-billing claims.

The quality of surveillance information on diabetes in Canada has increased substantially during the last decade [1]. However, diabetes rates estimated from administrative data may be affected by changes in data characteristics or collection methods such as coding/classification systems, clinical practices, billing methods or patient factors. Comparisons with rates previously published by the Department of Health or PHAC must be made with caution; rates in this report are definitive should a discrepancy exist.

The surveillance system cannot distinguish between type 1 and type 2 diabetes. Because type 2 diabetes accounts for about 90 to 95 per cent of the cases of diagnosed diabetes in

adults, trends in diabetes observed in the data are likely to be reflective of true trends in type 2 diabetes in the adult population. It is less certain how well the data reflect true trends in type 1 diabetes (previously known as juvenile diabetes), since type 2 diabetes is being increasingly diagnosed in children and youth as a result of obesity. The data do not identify other (relatively uncommon) types of diabetes caused by specific genetic conditions or from surgery, medications, infections, pancreatic disease or other illnesses, which together account for less than five per cent of all diagnosed cases.

Data from population health surveys, laboratory testing and vital statistics provide additional information on diabetes, its risk factors and impacts. Since this report uses multiple data sources, estimates may be reported for different reference periods and age groups, and definitions may vary depending on the source. Specific conventions are used to distinguish between different reference periods of data collection. The format "20XX-YY" indicates a fiscal year running from April 1, 20XX, to March 31, 20YY; data spanning more than a year are reported as "20XX–20YY."

For key measures, 95 per cent confidence intervals were calculated to ascertain the degree of variability associated with the rates and help in reaching conclusions about whether the observed differences reflect a true pattern, rather than an effect driven by sampling variability, coincidence or chance.

Each data source has its strengths and limitations, and reported diabetes rates may vary by data source because of differences in methodologies. For example, according to results from the 2014 CCHS, the prevalence of self-reported diabetes among male New Brunswickers 12 and older was 9.0 per cent (95% CI: 7.0-11.0%) and among females 7.8 per cent (95% CI: 6.2-9.4%), based on a sample yielding some 255 cases. In comparison, CCDSS data indicate a prevalence of diagnosed diabetes among male New

Brunswickers of 10.3 per cent (95% CI: 10.2-10.4%) and among females 9.3 per cent (95% CI: 9.2-9.4%), based on some 74,740 observed cases among individuals one and older.

For all sources, descriptions of diabetes incidence and prevalence exclude undiagnosed cases in the population. According to data obtained from blood samples, up to 20 per cent of diabetes cases in Canada are undiagnosed [1]. Important efforts within the health-care system to improve chronic disease detection and management means the number of individuals who are unaware of their condition is likely decreasing.

References

1. Public Health Agency of Canada, *Diabetes in Canada: Facts and figures from a public health perspective*. Ottawa, 2011 (http://www.phac-aspc.gc.ca/cd-mc/publications/diabetes-diabete/facts-figures-faits-chiffres-2011/index-eng.php, accessed Sept. 12, 2016).

2. World Health Organization, *Global Report on Diabetes*. Geneva, 2016 (http://www.who.int/diabetes/global-report, accessed Sept. 12, 2016).

3. Statistics Canada, *Health Status: Diabetes.* Ottawa (http://www.statcan.gc.ca/pub/82-229-x/2009001/status/dia-eng.htm, accessed Sept. 12, 2016).

4. Conference Board of Canada, *Mortality Due to Diabetes*. Ottawa, 2012 (http://www.conferenceboard.ca/hcp/details/health/mortality-diabetes.aspx , accessed Sept. 12, 2016).

5. New Brunswick Department of Health, *Diabetes in New Brunswick, 1998-2007*. Fredericton, 2010 (http://www.gnb.ca/0051/pub/pdf/2010/diabetes_report_1998-2007-e.pdf, accessed Sept. 30, 2016).

6. New Brunswick Department of Health and Wellness, *Diabetes in New Brunswick: Prevalence, incidence, mortality and selected co-morbidities, 1997/98 to 2001/02.* Fredericton, 2005.

7. Organisation for Economic Cooperation and Development, *Health at a Glance 2013*. Paris, 2013.

8. Gale EA, Gillespie KM, "Diabetes and gender." *Diabetologia*, 2001; 44(1):3-15.

9. Meisinger C et al., "Sex differences in risk factors for incident type 2 Diabetes Mellitus: The MONICA Augsburg Cohort Study." *Archives of Internal Medicine*, 2002; 162(1): 82-89.

10. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee, "Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada." *Canadian Journal of Diabetes*, 2013: 37(suppl 1):S1-S212 (http://guidelines.diabetes.ca, accessed Aug. 25, 2016).

11. Bonora E, Tuomilehto J, "The Pros and Cons of Diagnosing Diabetes with A1C." *Diabetes Care*, 2011; 34(Supplement 2): S184-S190.

12. Canadian Institute for Health Information, *Diabetes Care Gaps and Disparities in Canada*. Ottawa, 2009.

13. Canadian Agency for Drugs and Technologies in Health, *Systematic Review of Use of Blood Glucose Test Strips for the Management of Diabetes Mellitus*. Optimal Therapy Report, Ottawa, 2009.

14. Statistics Canada, "Table 051-0001: Estimates of population, by age group and sex for July 1, Canada, provinces and territories." *CANSIM* [online database]. Ottawa (http://www5.statcan.gc.ca/cansim, accessed Sept. 30, 2016).

15. Statistics Canada, *Population projections: Canada, the provinces and territories, 2013 to 2063*. Ottawa, 2014.

16. Public Health Agency of Canada, *Chronic Disease Infobase* (http://infobase.phac-aspc.gc.ca/cubes/data-cubes-eng.html, accessed Aug. 25, 2016).

17. Statistics Canada, "Table 105-0501: Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2013 boundaries)." *CANSIM* [online database]. Ottawa (http://www5.statcan.gc.ca/cansim, accessed July 18, 2016).

18. Statistics Canada, "Table 105-0503: Health indicator profile, age-standardized rate, annual estimates, by sex, Canada, provinces and territories." *CANSIM* [online database]. Ottawa (http://www5.statcan.gc.ca/cansim, accessed July 18, 2016).

19. World Health Organization, "Raised fasting blood glucose (≥7.0 mmol/L or on medication)." *Global Health Observatory data repository* [online database]. Geneva (http://apps.who.int/gho/data/view.main.2469, accessed Aug. 30, 2016).

20. Statistics Canada, "Table 102-0563: Leading causes of death, total population, by sex, Canada, provinces and territories." *CANSIM* [online database]. Ottawa (http://www5.statcan.gc.ca/cansim, accessed Aug. 30, 2016).

21. Service New Brunswick, *Vital Statistics: Annual Statistics*. Fredericton (http://www.snb.ca/e/1000/1000-01/e/annual-e.asp, accessed Aug. 12, 2016).

22. Statistics Canada, "Table 102-0552: Deaths and mortality rate, by selected grouped causes and sex, Canada, provinces and territories." *CANSIM* [online database]. Ottawa (http://www5.statcan.gc.ca/cansim, accessed May 10, 2016).

23. Statistics Canada, *Diabetes, 2014.* Ottawa, 2015 (http://www.statcan.gc.ca/pub/82-625-x/2015001/article/14180-eng.htm, accessed Sept. 12, 2016).

24. Statistics Canada, *Overweight and obese adults (self-reported), 2014*. Ottawa, 2015 (http://www.statcan.gc.ca/pub/82-625-x/2015001/article/14185-eng.htm, accessed Sept. 12, 2016).

25. Statistics Canada, *Overweight and obese youth (self-reported), 2014*. Ottawa, 2015 (http://www.statcan.gc.ca/pub/82-625-x/2015001/article/14186-eng.htm, accessed Sept. 12, 2016).

26. Canadian Institute for Health Information, *Learning From the Best: Benchmarking Canada's Health System*. Ottawa, 2011.

27. New Brunswick Department of Health, *Health Inequities in New Brunswick*. Fredericton, 2016 (http://www2.gnb.ca/content/dam/gnb/Departments/h-s/pdf/en/Publications/HealthInequitiesNewBrunswick2016.pdf).

28. Canadian Institute for Health Information, *Health Inequalities Interactive Tool: Diabetes* (https://www.cihi.ca/en/factors-influencing-health/socio-economic/health-inequalities-interactive-tool-diabetes-combined, accessed Aug. 10, 2016).

29. Canadian Diabetes Association, *The Burden of Out-of-Pocket Costs for Canadians with Diabetes*. Toronto, 2011.

30. Anand SS, Islam S, Rosengren A et al., "Risk factors for myocardial infarction in women and men: insights from the INTERHEART study." *European Heart Journal*, 2008; 29(7), 932-940.

31. New Brunswick Department of Health, *A Comprehensive Diabetes Strategy for New Brunswickers, 2011-15*. Fredericton, 2011.

32. Eriksson J, Lindström J, Tuomilehto J, "Potential for the prevention of type 2 diabetes." *British Medical Bulletin*, 2001: 60(1): 183-199.

33. Public Health Agency of Canada, *Surveillance: Canadian Chronic Disease Surveillance System*. Ottawa (http://www.phac-aspc.gc.ca/surveillance-eng.php, accessed Sept. 12, 2016).