Health Canada Santé Canada

Diabetes in Canada

Second Edition

Canada

Diabetes in Canada

Second Edition

Center for Chronic Disease Prevention and Control

Population and Public Health Branch

Health Canada

2002

Acknowledgements

We would like to thank the following for their contributions to the production of this report.

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Special Acknowledgements

Health Canada is grateful for the collaboration and partnership established with the following organizations in the production of the *Diabetes in Canada – Second Edition*.

National Diabetes Steering Committee

All Provinces and Territories

Assembly of First Nations

Canadian Diabetes Association

Canadian Institute for Health Information

Canadian Institute of Health Research

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Canadian National Institute for the Blind

Canadian Pharmacists Association

Diabète Québec

Heart and Stroke Foundation of Canada

Juvenile Diabetes Research Foundation

National Aboriginal Diabetes Association

The Kidney Foundation of Canada

Foreword

Diabetes in Canada – Second Edition incorporates data from the National Diabetes Surveillance System (NDSS) as well as data from other sources. The first edition was published in 1999 by Health Canada. This second edition has been a collaborative effort between Health Canada and the many partner organizations acknowledged in this report.

Diabetes in Canada – Second Edition has been prepared primarily to inform Canadians about the burden of diabetes. It is also a resource for policy and program decision-makers in government, the health care sector and volunteer organizations. Its purpose is also to raise awareness about diabetes and support the development of effective health care policies and programs across Canada.

If you have comments on this report, please contact:

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The report is also available on the Web at Health Canada Website: www.hc-sc.gc.ca

REPORT Highlights

Chapter 1 Diabetes

Diabetes is a chronic condition that results from the body's inability to sufficiently produce and/or properly use insulin. Insulin, a hormone secreted from beta cells in the pancreas, assists with the conversion of glucose into energy. Without insulin, the cells of the body, primarily in muscle, fat, and liver tissue, cannot absorb sufficient glucose from the bloodstream. Chronic high levels of blood glucose can result in long-term damage, leading to the dysfunction and failure of various organs, such as the kidneys, eyes, nerves, heart, and blood vessels. Complications in these organs can lead to death.

Diabetes occurs in several forms: type 1, type 2, and gestational diabetes. Type 1 and type 2 are the two most common forms of this chronic disease and represent about 10% and 90% of the total diabetic population respectively.

Chapter 2 Prevalence and Incidence

Diabetes continues to be a significant health problem in Canada. The administrative data from the NDSS, based on information from all provinces and territories with the exception of New Brunswick, Newfoundland and Labrador, Northwest Territories and Nunavut, identified a prevalence of physician-diagnosed diabetes of 4.8% among people aged 20+ years (approximately 1,054,100 in 1998/99). The true prevalence may be significantly higher however, as it has been estimated that as many as one third of all cases of diabetes are undiagnosed in Canada. Therefore, altogether, there may have been as many as 1.7 million Canadians with diabetes during 1998/99.

Chapter 3 Risk Factors

The Canadian Diabetes Strategy has adopted a population health approach to prevent diabetes and improve its control. This strategy will reduce the risk of diabetes

developing in individuals without the disease and reduce the risk of complications among those living with it. This chapter presents data, derived from the National Population Health Survey (NPHS), on the prevalence of risk factors for diabetes.

Risk factors for type 2 diabetes remain very common in the general population. In fact, the proportion of men who are overweight is increasing. Unless this trend is reversed, it will have serious ramifications for the prevalence of diabetes in the future. Although it is encouraging that both men and women are becoming more physically active, efforts to encourage regular physical activity must continue. In individuals with diabetes, risk factors such as high blood pressure, smoking, being overweight, and physical inactivity, which are associated with poor blood sugar control and diabetes-related complications, remain very common. Because the complications of diabetes reduce both the life span and the quality of life, this requires action as a high priority.

Chapter 4 Health Outcomes

Diabetes exerts a significant effect on the quality of life of those with the disease. The continuous need to monitor intake (in terms of timing, type, and amount of food), take medication (whether pills or insulin injections), monitor blood glucose, and anticipate and plan for activities that may affect diabetes control can put a severe strain on daily life. This is a particular challenge for children and youth with diabetes, who face the task of fitting in with their peers while coping with the demands of treatment. In addition, the complications of diabetes can cause other serious health problems that may lead to disability or be life-threatening.

Individuals with diabetes are less likely than those without diabetes to report good health. In addition, they more often report that they experience activity restriction. The negative impact of diabetes may be due to diabetes-related complications and/or the challenges associated with diabetes care.

The higher rate of mortality due to diabetes among men than women is consistent with the slightly higher prevalence of diabetes among men. In addition, men tend to develop cardiovascular disease complications, which carry a high mortality rate, more often than women.

The levelling off of mortality rates may mislead health planners into thinking that the diabetes problem has stabilized. In fact, it is projected that the number of deaths will increase in the future in both men and women because the population is aging. These individuals will need a variety of health services in the acute, chronic, and home care sectors for many years before death. Thus, coping with this increasing need for service requires immediate preparation, not only to address the current situation but also to be effective for the next 20 years.

Chapter 5 Use of Health Services and Costs

Individuals with diabetes require a variety of health services, not only for the control of their disease but also for the diagnosis and treatment of associated complications. Therapy for individuals with diabetes aims to control blood sugar, blood pressure, and blood lipids levels; to reduce symptoms and the risk of complications; and to enhance the quality of life. Blood sugar levels can be controlled through diet and anti-hyperglycemic drugs taken orally and/or by injections of insulin combined with lifestyle modification (healthy eating, active living, smoking avoidance/cessation, and stress management). Pharmacologic interventions combined with these lifestyle modifications also form a necessary part of managing the complications of diabetes.

The data on medication use support the nature of type 2 diabetes: that it can be controlled early in the course of the disease in some circumstances without the use of insulin. The increase in total units of hypoglycemic agents dispensed over time may be due to their high use among seniors, a segment of the population that is growing over time. This increase may also reflect the aggressive management of the disease with the use of medication to more closely control blood sugar, since type 2 diabetes is a progressive disease.

The higher hospitalization rate among men than women may be a consequence of the higher rate of cardiovascular complications among men. The lack of a decrease in hospitalization rates for diabetes in any age group contradicts the hospitalization rate in general, which has shown a steady decrease in the past several years. This may signal that the level of serious health problems among individuals with diabetes has not decreased. It also attests to continued pressure on hospital budgets.

In Canada, the economic burden of diabetes alone is estimated at $1.6 billion in 1998; $0.4 billion (25%) in direct costs and $1.2 billion (75%) in indirect costs. This estimate is a very conservative one and does not include physician costs. In addition, the hospital costs include only the leading cause of hospitalization, and this results in an underestimation of the real burden of diabetes, because the cost of the complications of diabetes are not captured.

Chapter 6 Diabetes in the Aboriginal Communities

The high prevalence of diabetes among Aboriginal peoples (higher than in the general population), the greater severity at diagnosis and the high rates of complications are a few indicators of the importance of this issue to all Aboriginal communities.

In addition, several risk factors have an enormous impact on diabetes in Aboriginal groups and have worsened the disease for a population already at risk.

The overall prevalence of diabetes among Aboriginals and the complications of the disease are expected to increase in future years and will represent a huge burden for health authorities. A study conducted in Manitoba showed the magnitude of this problem. It is estimated that between 1996 and 2016 there will be a 10-fold increase in the rate of cardiovascular disease, a 5-fold increase in strokes, 10 times as many dialysis starts, 10 times the rate of lower extremity amputations, and 5 times the rate of blindness.

Despite the lack of information on the precise costs of diabetes among Aboriginals, it is estimated that the costs are high as a result of both the high prevalence of diabetes and the substantial utilization of health care services by people with diabetes.

Because of the serious consequences of diabetes for individuals and their communities, the prevention of diabetes is therefore imperative and is the key to reducing this epidemic. Public health policies and especially community-based diabetes projects must be developed and implemented in order to reduce the burden of diabetes among Aboriginal peoples.

A Final Word

A full understanding of the implications of diabetes on the lives of Canadians requires more data to differentiate between the types of diabetes. More data will be needed in the following areas:

- incidence and prevalence;
- risk factors in children and youth;
- complications of diabetes;
- utilization of outpatient services;
- attendance at educational programs;
- economic impact of diabetes; and
- quality of life and impact on family, school and work.

The difficulties in obtaining accurate data on the prevalence and incidence of diabetes highlight the need for an ongoing comprehensive surveillance system. The NDSS addresses the critical information gaps regarding diabetes in Canada. The goal of the NDSS is to develop a national standardized database for diabetes surveillance with long-term monitoring for diabetes-related complications and health services utilization. However, other sources, such as the NPHS and the Canadian Community Health Survey (CCHS) will continue to provide important socio-economic data, and it is imperative that they be continued.

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Introduction

Diabetes in Canada – Second Edition brings together data on the prevalence and incidence of diabetes, risk factors, health outcomes, and use of health services. Ideally, the report would include data specific to type 1 and type 2 diabetes and gestational diabetes. Unfortunately, the available data sources do not differentiate between the three.

Data Sources

Several national data sources were accessed in the preparation of *Diabetes in Canada – Second Edition*

Hospital Morbidity Database (HMDB) – Canadian Institute for Health Information

Mortality Database – Statistics Canada

National Diabetes Surveillance System (NDSS) – Health Canada

National Longitudinal Survey of Children and Youth (NLSCY) – Human Resource Development Canada (HRDC)

National Population Health Survey (NPHS) – Statistics Canada

Aboriginal Peoples Survey (APS) – Statistics Canada

IMS Health Dataset (IMS) – Canadian Retail Pharmacies

For a brief description of these data sources, see *Appendix B – List of Data Sources*.

The first *Diabetes in Canada* report in 1999 highlighted the need for better data, in particular, data on the prevalence and incidence of diabetes, its complications, the use of health care services, and the effectiveness of prevention and control initiatives. In response, the Diabetes Council of Canada took the lead in creating the NDSS. This report includes the first published data from the NDSS from all participating provinces and territories. In addition, Statistics Canada introduced the Canadian Community Health Survey (CCHS), a cross sectional survey that was

designed to address some of the weaknesses of the NPHS. Unfortunately, the first results of this survey were unavailable to meet the deadline for this publication.

Limitations of the Data

Those sources able to provide a national picture had some limitations:

- unable to differentiate between type 1 and type 2 diabetes and gestational diabetes;
- only persons 20 years and older are included.

The analyses of data from both the National Diabetes Surveillance System (NDSS) and the National Population Health Survey (NPHS) were restricted to age groups 20 years of age and older. In the NDSS, the case definition has been validated only for those 20 years of age and older, and in the NPHS the sample of those 12-19 years of age with self-reported diabetes was too small to obtain reliable estimates. Since type 1 diabetes occurs mainly in the juvenile population, specific information about type 1 diabetes and related factors cannot be extracted from the data in its current form. Note also that the data used were not always available over consistent time-frames; for example, some were available by fiscal year, and some by calendar year.

In addition to the lack of differentiation between the various types of diabetes, other data gaps exist that inhibit the creation of a comprehensive picture of diabetes in Canada:

- data on the prevalence and risk factors in persons under the age of 20;
- complications of diabetes;
- utilization of outpatient services;
- attendance at educational programs;
- economic impact of diabetes; and
- quality of life and impact on family, school and work.

Fortunately there is the potential for both the NDSS and the CCHS to significantly narrow the data gaps. The NDSS has the potential to be able to provide additional information especially regarding the complications related to diabetes and health services utilization and the CCHS has the potential to provide improved information concerning risk factors and health determinants. However, even with these important additions, it may still require additional data sources to develop a truly comprehensive picture of diabetes in Canada.

Statistical Notes

Interpreting the Numbers

Throughout the document, the reader will notice differences in the results from the NPHS data for age groups, years, or provinces and territories. These differences may not be

real, however, but simply artefacts due to sampling. The NPHS includes only a sample of the population rather than the entire population; the resulting numbers, therefore, are only estimates of the true values for the population.

The 95% confidence intervals (CIs) of all estimates were calculated during the preparation of the report. We can be 95% certain that the true value for the population lies somewhere in this range of values. If the text reports a difference between two values and the 95% CIs of the values do not overlap, then one can be reasonably sure that a true difference exists. If the text does not report on a difference in the values, then the reader should assume that none exists.

The coefficient of variation (CV) indicates the quality of a population estimate. A CV of 16.7-25.5 indicates moderate sampling variability. A CV of 25.6-33.3 indicates high sampling variability. Estimates with either a moderate or high CV should be interpreted with caution. In some situations, the sample in the survey was too small to produce a reliable estimate; these numbers are not included in the report.

Age Groups

Five age categories were selected for this report based on homogeneity of individuals in each age range. The 0-19 year-old age group consists of children and youth in the period of greatest physical growth and development, who experiment with various health behaviours. Those aged between 20 and 39 years are young adults, generally healthy and without serious health problems but in the process of establishing behaviours that will affect their health later in life. The 40-59 year-old age group represents adults in their middle years, when serious health problems become more prevalent. The 60-74 year-old age group may be described as "young seniors", whose health problems become not only more frequent but also more serious. The final age group consists of adults aged 75 years and older.

Organization of Report

Each chapter in *Diabetes in Canada – Second Edition* consists of an introduction, a summary of the available national data in tables and figures, and a discussion of the implications of the results. The chapters address the following questions:

Chapter 1 *Diabetes*

"What is diabetes?"

Objective: To describe the various types of diabetes (type 1, type 2 and gestational) and the related complications.

Chapter 2 *Prevalence and Incidence*

"Who has diabetes now?"

Objective: To describe the frequency of the disease in Canada.

Chapter 3 *Risk Factors*

"Who is at risk of developing diabetes and diabetes complications?"

Objective: To describe several risk factors related to developing diabetes and its complications.

Chapter 4 *Health Outcomes*

"What happens to people with diabetes once diabetes sets in?"

Objective: To describe how diabetes and its complications affect the quality of life and contribute to early mortality.

Chapter 5 *Use of Health Services and Costs*

"What health services do people with diabetes use?" "What is the economic impact of the disease?"

Objective: To monitor the use of health services and to assess the burden of diabetes on the health care system.

Chapter 6 *Diabetes in Aboriginal Communities*

"How does diabetes affect the Aboriginal community?"

Objective: To give information on the frequency, risk factors, complications and the use of health services specific to Aboriginal communities.

As already noted, the report cannot provide comprehensive answers to these questions at this time. However, the data sources continue to improve: *Diabetes in Canada – Second Edition* is one more step in the evolution of a comprehensive diabetes surveillance and monitoring system.

CHAPTER 1

Diabetes

Introduction

Diabetes mellitus (DM) is a chronic condition that results from the body's inability to sufficiently produce and/or properly use insulin. Insulin, a hormone secreted from beta cells in the pancreas, assists in the conversion of glucose into energy. Without insulin, the cells of the body, primarily in muscle, fat and liver tissue, cannot absorb sufficient glucose from the bloodstream. Consistent high levels of blood glucose can result in long-term damage, leading to the dysfunction and failure of various organs, such as the kidneys, eyes, nerves, heart and blood vessels. Complications in these organs can lead to death.

Diabetes mellitus is not a single disease, it occurs in several forms: type 1, type 2 and gestational diabetes. Type 1 and type 2 are the two most common forms of this chronic disease and represent about 10% and 90% respectively of the total diabetic population[1].

Type 1 Diabetes

Type 1 diabetes, previously known as insulin-dependent diabetes mellitus (IDDM), typically occurs in childhood or early adolescence, and treatment usually entails multiple daily injections of insulin for survival.

In type 1 diabetes, the immune system attacks the insulin-producing beta cells in the pancreas and destroys them. As a result, the pancreas then produces little or no insulin. Type 1 diabetes is not caused by obesity or by eating excessive sugar; rather, it is believed to be caused by a combination of genetic factors and environmental stressors. Scientists do not know exactly what causes the body's immune system to attack the beta cells, but they believe that both genetic factors and viruses are involved. Even when insulin is injected regularly, type 1 diabetes usually results in a drastic reduction in the quality of life and shortens the average life span by 15 years[2,3].

Symptoms of type 1 diabetes include increased thirst, frequent urination, constant hunger, weight loss, blurred vision and extreme tiredness. If the condition is not diagnosed and treated in time with insulin, patients can lapse into a life-threatening coma. The characteristics of type 1 are as follows[4]:

- It is one of the most serious chronic diseases, affecting young children and adolescents.
- Insulin can help people with type 1 diabetes to maintain and balance their blood sugars, but it does not cure diabetes nor does it prevent its devastating comorbidity such as kidney failure, blindness, nerve damage, amputations, heart attack and stroke.
- People with type 1 diabetes must take multiple daily insulin injections and test their blood sugar several times per day. While trying to balance insulin injections with their amount of food intake, those with type 1 diabetes must constantly be prepared for potential hypoglycemic and hyperglycemic reactions, which can be life threatening.
- A person's blood sugar can fluctuate with hormonal changes, periods of growth, physical activity, medications, illness/infection and emotions. Therefore, it is extremely challenging to manage type 1 diabetes, especially among children.

Type 2 Diabetes

Type 2 diabetes, previously known as non insulin-dependent diabetes mellitus (NIDDM), is the most common form of diabetes. It accounts for more than 90% of diagnosed diabetes. Type 2 diabetes typically occurs after the age of 40 years and is found in a higher proportion of individuals who are considered overweight. Individuals with type 2 diabetes are usually insulin resistant. By losing weight, exercising, or taking medications orally, most people with type 2 diabetes can overcome this resistance to insulin; however, some require daily insulin injections[2].

Type 2 diabetes is now widely considered to be one component in a group of disorders called the metabolic syndrome, which includes insulin resistance, cholesterol and lipid disorders, obesity, high blood pressure, a high risk of blood clotting and disturbed blood flow to many organs[1]. Life expectancy is reduced by about 5 to 10 years among middle-aged adults with type 2 diabetes[3].

The mechanisms of type 2 diabetes are not fully understood, but some experts suggest that it may involve the following three stages[4]:

1) The first stage in type 2 diabetes is the condition called *insulin resistance*; although insulin can attach normally to receptors on liver and muscle cells,

certain mechanisms prevent insulin from moving glucose (blood sugar) into these cells where it can be used. Most type 2 diabetics produce variable, even normal or high, amounts of insulin, and in the beginning this amount is usually sufficient to overcome such resistance.

2) Over time, the pancreas becomes unable to produce enough insulin to overcome resistance. In type 2 diabetes, the initial effect of this second stage is usually an abnormal rise in blood sugar after a meal, called *postprandial hyperglycemia*. This effect is considered to be particularly damaging.

3) Eventually, the cycle of elevated glucose further impairs and possibly destroys beta cells, thereby stopping insulin production completely and causing full-blown diabetes. This is evident in *fasting hyperglycemia*, a state of elevated glucose levels that is present during most of this stage.

Gestational Diabetes

Gestational diabetes mellitus (GDM) occurs in some women during pregnancy. In most cases, it ends after birth. GDM is a very strong risk factor for the development of type 2 diabetes later in life: up to 40% of women with GDM may develop type 2 diabetes when they get older[7]. According to the 1996/97 National Longitudinal Study on Children and Youth (NLSCY), approximately 6.5% of women reported that they had received a diagnosis of gestational diabetes[8]

These women develop glucose intolerance that can be treated with diet and/or insulin. However, if the glucose intolerance is not well controlled, GDM can be associated with an increased incidence of fetal macrosomia ("big babies"), pre-eclampsia, and Cesarean section, which affects both the health of the baby and the birth[9]. Some studies have shown perinatal mortality to be increased in untreated GDM[10,11]. GDM cannot be treated with pills that lower blood glucose as these medicines can cause harm to the baby.

The diagnosis of GDM is commonly based on the criteria of O'Sullivan and Mahan[12] and the World Health Organization (WHO)[13]. The management strategy for GDM focuses on screening, patient education, glycemic control and perinatal surveillance.

Diagnosis of Diabetes Mellitus

In 1997, the new criteria for diagnosis and classification terminology were developed. All diabetes is diagnosed by one of three criteria:

- symptoms of diabetes (fatigue, excessive thirst, excessive urination and unexplained weight loss) plus a casual plasma glucose value of ≥ 11.1 mmol/L, OR

- a fasting (no caloric intake for at least 6 hours) plasma glucose test (FPG) of ≥ 7.0 mmol/L. (In 1998, the criterion was lowered from 7.8 to 7.0; this likely resulted in an increase in the number of individuals with a diagnosis of the disease), OR
- A plasma glucose value in the 2-hour sample (2hrPG) of the oral glucose tolerance test (OGTT) ≥ 11.1 mmol/L[12].

Complications

The complications of diabetes are strongly related to high blood sugar levels and are mostly correlated with the duration of diabetes. Long-term complications may occur in both type 1 and type 2 diabetes. Complications of diabetes may include microvascular changes, resulting in retinopathy, nephropathy and neuropathy. After 20 years of diabetes, nearly all patients with type 1 diabetes and over 60% of patients with type 2 diabetes have some degree of retinopathy[12].

The long-term complications of diabetes affect many parts of the body, decrease quality of life for the individual with diabetes and increase the use of health services. Table 1-1 gives a description of the most common complications and their related outcomes.

Individuals with diabetes may face shortened life expectancy due to complications from the disease. Life expectancy is influenced by the age at the onset of diabetes. Good control of blood sugar, blood pressure and blood lipids through the adoption of a healthy diet, weight management, regular physical activity, and/or medication can decrease the risk of diabetes complications and increase life expectancy.

Table 1-1 Diabetes Complications

Complication Type	Description	Possible Outcomes
Microvascular (or peripheral vascular disease) • small blood vessel damage	Small blood vessel damage that contributes to a decrease in blood circulation	Retinopathy (eye disease) Nephropathy (kidney disease that leads to renal failure requiring dialysis) Periodontal disease
Macrovascular • large blood vessel damage	Large blood vessel damage that contributes to a decrease in blood circulation	Cardiovascular disease Cerebrovascular disease Stroke Ischemic heart disease Lower limb amputation
Neuropathy • nervous system disease	Diabetic neuropathy is a group of nerve diseases. All these disorders affect the peripheral nerves. There are three types of peripheral nerves: motor, sensory, and autonomic.	Foot infections and ulceration Decreased sensation Increased sensitivity Muscle wasting Sexual dysfunction
Retinopathy • eye disease	Diabetic retinopathy is a general term for all disorders of the retina caused by diabetes. There are two major types of retinopathy: nonproliferative and proliferative.	Glaucoma Cataracts and blindness

References

1. Centers for Disease Control and Prevention. *National diabetes fact sheet: national estimates and general information on diabetes in the United States*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 1997.
2. The National Institute of Diabetes and Digestive and Kidney Diseases. *Well-connected report: type 1 diabetes*. US. 2002.
3. Sasaki A. *Assessment of the new criteria for diabetes mellitus according to 10-year relative survival rates*. Diabetologia 1981;20(3):195-8.
4. American Diabetes Association. *Clinical practice recommendations*. U.S. 2000.

5. O'Sullivan JB. The Boston Gestational Diabetes Studies: review and perspectives. In: Sutherland HW, Stowers JM, Pearson DWM, editors. *Carbohydrate metabolism in pregnancy and the newborn*. London: Springer-Verlag, 1989: 287-294.

6. Human Resource Development Canada (HRDC). National Longitudinal Survey of Children and Youth (NLSCY). Ottawa, 1996-1997.

7. Naylor CD, Sermer M, Chen E et al. *Selective screening for gestational diabetes mellitus*. N Engl J Med 1997;337:1591-96.

8. Pettitt DJ, Knowler WC, Baird HR, Bennett PH. *Gestational diabetes: infant and maternal complications of pregnancy in relation to third trimester glucose tolerance in Pima Indians*. Diabetes Care 1980;3:458-64.

9. Oats JN, Beischer NA. *Gestational diabetes*. Aust N Z J Obstet Gynaecol 1986;26:2-10.

10. O'Sullivan JB, Mahan CM. *Criteria for the oral glucose tolerance test in pregnancy*. Diabetes 1964;13:278-85.

11. World Health Organization Study Group. *Diabetes mellitus*. World Health Organ Tech Rep Ser 1985;727:13-14.

12. Meltzer S, Leiter L, Daneman D, Gerstein H, Lau D, Ludwig S et al. *1998 clinical practice guidelines for the management of diabetes in Canada*. Can Med Assoc J 1998;39 (8:Suppl):S6.

13. Health Canada. *Diabetes in Canada: national statistics and opportunities for improved surveillance, prevention, and control (1999)*. Ottawa: Health Canada, page 27.

CHAPTER 2

Prevalence and Incidence

Introduction

The ability to determine the extent of the disease on a national scale has been limited. The National Population Health Survey (NPHS) has been conducted three times (1994/1995, 1996/1997, 1998/1999), but for the most part the sample size has made it difficult to produce statistically significant analysis for anything but a national analysis. Therefore, these data are not particularly useful for provincial and territorial analysis and some other subpopulations. To fill this void, a number of surveys have been conducted aimed at specific subpopulations, especially Aboriginal communities and also people with type 1 diabetes. More recently, the National Diabetes Surveillance System (NDSS) has been implemented to address some of these limitations.

The National Diabetes Surveillance System (NDSS), within the framework of the Canadian Diabetes Strategy, is still in its infancy but prevalence information was available for this report. One of the significant strengths of the NDSS is that it is based on physician services data and hospitalization data and it does not rely on self-reporting of diabetes status.

The surveys or systems have not yet been able to differentiate between type 1 and type 2 diabetes. Best estimates have shown that about 10% of all people with diabetes mellitus have type 1 and about 90% have type 2[1]. The NPHS is limited to those 12 years of age and over, and the NDSS data have been validated only for people aged 20 years and over, although work continues to improve this system. In addition, because type 1 diabetes tends to occur mainly in younger people, it is difficult to give a comprehensive picture of this type of diabetes.

The frequency of a disease may be measured in two (standard) ways:

Incidence is the number of new cases detected in the population at risk for the disease during a specific period.

Prevalence is the total number of persons known to have had the disease at any time during a specific period. It gives an idea of the importance/burden of disease at a given time, and it is widely used in public health monitoring and planning.

Data

According to the NDSS, 4.8% of Canadians aged 20 years and older in the participating provinces/territories had diabetes (4.6% of women and 5.0% of men) in 1998/99. Unfortunately, the data do not differentiate between type 1 and type 2 diabetes.

According to the NDSS, the proportion of adults with diabetes increased with age and was higher among men than women (Figure 2-1).

The 1998/99 NDSS provided an estimate that 1,054,100 adults in Canada had diabetes diagnosed by a health professional and, of these, 40.6% were between the ages of 20 and 59 years (Table 2-1). There is no estimate of the younger age groups in NDSS, at this time.

The prevalence of diabetes by provinces and territories (Figure 2-2) shows that Nova Scotia has the highest prevalence while Yukon has the lowest. In addition, men have a higher prevalence of diabetes compared to women.

Table 2-1 Prevalence of Diagnosed Diabetes by Age Group and Sex

Age Group	Diagnosed diabetes among adults by age group and sex, Canada, 1998/99					
	Women		Men		Total	
Years	% (95% CI*)	Estimated no. of Canadians††	% (95% CI*)	Estimated no. of Canadians	% (95% CI*)	Estimated no. of Canadians
20-39	1.27 (1.26 – 1.28)	57,000	0.81 (0.81 – 0.81)	36,600	1.04 (1.03 – 1.05)	93,600
40-59	3.63 (3.61 – 3.65)	145,300	4.73 (4.71 – 4.75)	189,200	4.18 (4.17 – 4.19)	334,500
60-74	10.77 (10.72 – 10.82)	185,000	13.76 (13.71 – 13.81)	215,400	12.19 (12.16 – 12.23)	400,400
75+	12.36 (12.30 – 12.42)	128,400	15.35 (15.26 - 15.44)	97,200	13.49 (13.44 – 13.54)	225,500
All (20+)	4.59 (4.58 – 4.60)	515,800	5.02 (5.01 – 5.03)	538,300	4.80 (4.79 – 4.81)	1,054,100

* 95% Confidence Interval

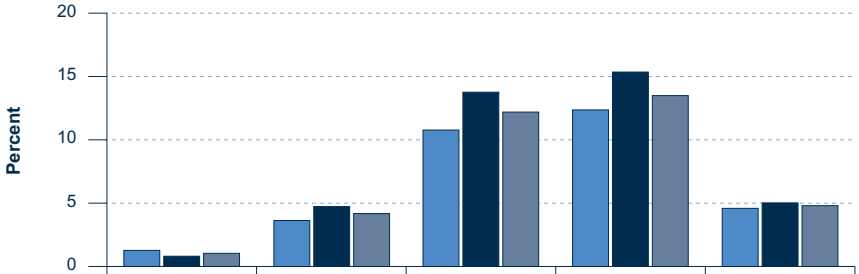
†† Numbers are rounded to the nearest 100

Note: The sum of the age groups and or sexes may not equal the total due to rounding.

Source: Health Canada, National Diabetes Surveillance System

Figure 2.1: Prevalence Rate of Diagnosed Diabetes

Prevalence rate of diagnosed diabetes among adults aged 20+ years in all provinces/territories excluding New Brunswick, Newfoundland and Labrador, Northwest Territories and Nunavut, by age group and sex, Canada 1998/99.



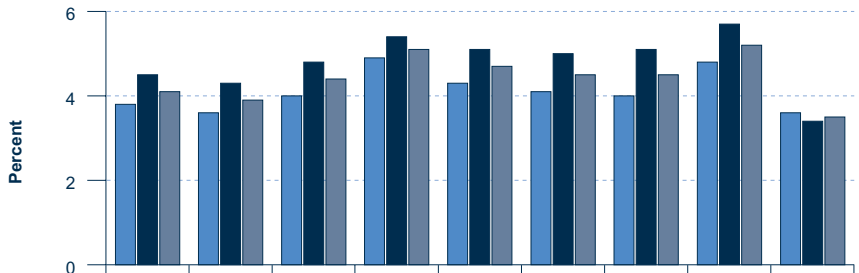
	20-39 years	40-59 years	60-74 years	75+ years	20+ years
Women	1.27	3.63	10.77	12.36	4.59
Men	0.81	4.73	13.76	15.35	5.02
Both	1.04	4.18	12.19	13.49	4.80

Age Group

Source: National Diabetes Surveillance System, Centre for Chronic Disease Prevention and Control, Health Canada.

Figure 2.2: Prevalence Rate of Diagnosed Diabetes

Prevalence rate of diagnosed diabetes among adults aged 20+ years by provinces/territories excluding New Brunswick, Newfoundland and Labrador, Northwest Territories and Nunavut, by sex, Canada 1998/99.



	B.C.	Alberta	Saskat-chewan	Manitoba	Ontario	Québec	P.E.I.	Nova Scotia	Yukon
Women	3.8	3.6	4.0	4.9	4.3	4.1	4.0	4.8	3.6
Men	4.5	4.2	4.8	5.3	5.1	5.0	5.1	5.6	3.4
Both	4.1	3.9	4.4	5.1	4.7	4.5	4.5	5.2	3.5

Provinces and Territories

Source: National Diabetes Surveillance System, Centre for Chronic Disease Prevention and Control, Health Canada.

* The data by gender is age-standardized, and the data for both is age and sex standardized.

Estimate of the number of Canadians with diabetes

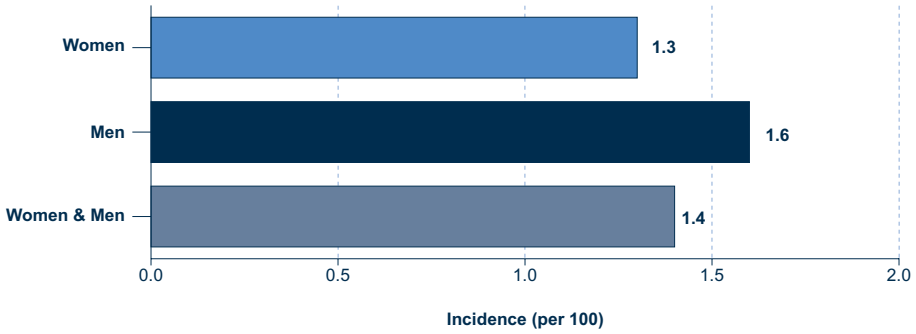
From the eight provinces that reported to NDSS, 1,054,100 cases* in Canadians over 20 years of age were reported. The number of cases in Newfoundland and New Brunswick were estimated using data from the NPHS (National Population Health Survey). A total of 57,400 cases were estimated for residents over 20 in those two provinces. Using information from NPHS and CCHS (Canadian Community Health Survey), it was calculated that there were 1,700 Cases for the three Territories. The total number of Canadians under 20 with diabetes was estimated using the American prevalence of 0.19%[2] multiplied by the total population of Canadians in this age group, to give

* Numbers are rounded to the nearest 100.

15,300 cases. These numbers were summed to get a total of 1,128,500 diagnosed cases of diabetes in 1998/99. It has been estimated that one third of all cases of diabetes are undiagnosed in Canada[3,4], so the number of diagnosed cases were multiplied by 50% to account for this problem. Altogether, there were approximately 1.7 million Canadians with diabetes during 1998/99.

Figure 2.3: Cumulative Incidence

Four-years cumulative incidence of self-reported diabetes among adults aged 20+ years by sex, Canada, from 1994 to 1998.



Source: Statistics Canada, National Population Health Survey.

Based on the NPHS Longitudinal Survey, between 1994 and 1998, 1.4 percent of adults developed diabetes (Figure 2-3). The difference between men and women was not statistically significant. Type 1 and type 2 diabetes are not differentiated in the NPHS results.

Summary of Findings

Diabetes continues to be a significant health problem in Canada. The administrative data from the NDSS, based on information from all provinces and territories with the exception of New Brunswick, Newfoundland and Labrador, Northwest Territories and Nunavut, identified a prevalence of physician-diagnosed diabetes of 4.8% among people aged 20+ years (approximately 1,054,100). The true prevalence may be significantly higher however, as it has been estimated that as many as one third of all cases of diabetes are undiagnosed in Canada. Therefore, altogether, there may be as many as 1.7 million Canadians with diabetes during 1998-1999.

The provincial/territorial administrative data indicate that the prevalence of diabetes increases with age and that the disease affects a higher proportion of men than women. The aging of the population will likely bring with it an increase in the number of seniors with diabetes. This could have a serious impact on services for seniors, in part because of diabetic complications that increase with age. Required services include not only acute care but also supportive services such as chronic care in hospital, home care, drug benefits, supportive housing and transportation.

The cumulative incidence over four years showed that 1.4 percent of adults developed diabetes. For comparison, the US Centers for Disease Control and Prevention report an annual incidence rate of approximately 2.9/1000 new cases of diabetes per year in the general population[5]. The NDSS will be able to provide an annual incidence rate in a few years.

The data presented in this chapter provide a snapshot of the prevalence and incidence of diabetes in Canada. Monitoring the impact of prevention programs will require data that are not only more comprehensive, but also of higher quality. It is anticipated that the NDSS database will be a major source of both prevalence and incidence data. Additional changes will require:

- the collection of data that differentiate between type 1 and type 2 diabetes;
- the collection of data on children and adolescents; and
- the expansion of the NDSS to all provinces and territories.

References

1. Centers for Disease Control and Prevention. *National diabetes fact sheet: national estimates and general information on diabetes in the United States*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 1997.

2. www.cdc.gov/diabetes/pubs/estimates.htm

3. Young Kue T., and Cameron A. Mustard. *Undiagnosed diabetes: Does it matter?* Can Med Assoc J 2001:164(1):24-28.

4. Harris MI, Flegal KM, Cowie CC et al. *Prevalence of diabetes, impaired fast glucose, and impaired glucose tolerance in U.S. adults*. Diabetes Care 1998:21(4):518-524.

5. Geiss LS, Herman WH, Goldschmid MG and al. *Surveillance for diabetes mellitus – United States, 1980-1989*. MMWR 1993;42(SS-2): 1-20.

CHAPTER 3

Risk Factors

Introduction

The Canadian Diabetes Strategy has adopted a population health approach to prevent diabetes and improve its control. This strategy will help to reduce the risk of diabetes developing in individuals without the disease and the risk of complications among those living with it. This chapter presents data, derived from the NPHS, on the prevalence of risk factors for diabetes and its complications.

Type 1 Diabetes

No known modifiable risk factors exist for acquiring type 1 diabetes (children and youth)[1] , a characteristic that limits the possibility of prevention. Non-modifiable risk factors include the following:

- Race and ethnic background: in the United States, the prevalence is higher among whites than among black or Hispanic people; as well, Scandinavian countries report higher rates.
- Age: incidence increases with age throughout childhood and adolescence.
- Genetic susceptibility: a family history of type 1 diabetes is associated with a slightly increased risk of developing type 1 diabetes.

Type 2 Diabetes

Weight and exercise are modifiable risk factors that can decrease the risk of developing type 2 diabetes among those at increased risk[2]. The prevalence of diabetes increases by 5% to 10% among adults for every 1 kg increase in population-measured body weight[3,4].

Complications of Diabetes

Diabetes has many complications for which there are a number of risk factors, such as cigarette smoking, dyslipidemia, and high blood pressure. Therefore, the control of these risk factors for diabetes complications forms an essential part of a comprehensive

diabetes control program. Since high blood pressure is associated with obesity and physical inactivity, maintaining a healthy weight and remaining physically active will protect against the complications of diabetes.

Socio-Economic Determinants of Health

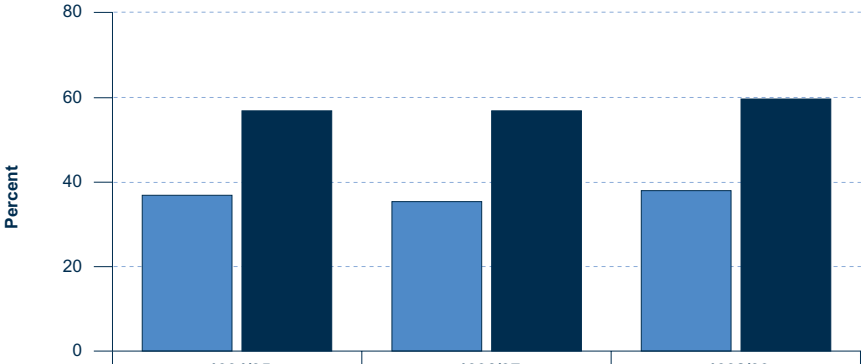
Socio-economic factors (education and income) heavily influence the adoption of healthy behaviours. Individuals with lower income and less formal education are more likely to smoke and to be physically inactive and overweight[5]. Therefore, programs and policies must address these underlying determinants of health in a comprehensive program to prevent diabetes. In the 1998/99 NPHS, 21.4% of individuals with diabetes reported low income, and 42.7% had not completed secondary school. In the general population, the proportions were 12.8% and 22.5% respectively.

Overweight

Diabetes is more common in individuals who are overweight. The risk of developing type 2 diabetes increases with the amount of excess weight, the duration of the obesity, and the central deposition of fat. Women who are overweight also have a greater risk of developing gestational diabetes. Being overweight and gaining weight are strong predictors of diabetes[6]. The Body Mass Index (BMI) is a standard measure to determine weight status. For the purpose of our analysis, we are using the World Health Organization's (WHO) measure, which considers a person to be overweight who has a BMI equal to or greater than 25.0 kg/m^2.

Figure 3.1: Proportion of Overweight Adults in Canada

Proportion of overweight[1] adults aged 20-59 years in the general population, Canada 1994/95-1998/99.



	1994/95	1996/97	1998/99
Women	36.9	35.4	38.0
Men	56.9	56.9	59.7

Sex and Year

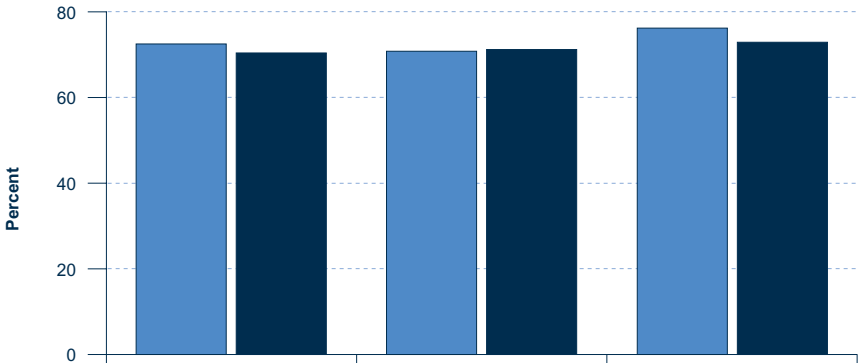
[1]Overweight, BMI = 25.0+

Source: Statistics Canada, National Population Health Survey.

According to the NPHS, the proportions of men and women who were overweight between 1994/95 and 1998/99 were similar (Figure 3-1). Among men, the proportion who were overweight increased slightly between 1994/95 and 1998/99. The difference, however, was not statistically significant. Women showed little change.

Figure 3.2: Overweight Adults with Self-Reported Diabetes

Proportion of overweight[1] adults aged 20-59 years with self-reported diabetes, Canada 1994/95-1998/99.



	1994/95	1996/97	1998/99
Women	72.5	70.8	76.2
Men	70.4	71.2	72.9

Sex and Year

[1]Overweight, BMI = 25.0+

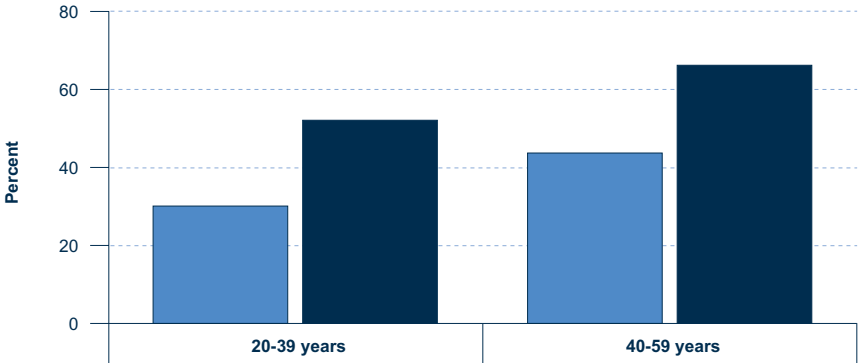
Source: Statistics Canada, National Population Health Survey.

diabetes who were overweight remained similar throughout the three surveys (Figure 3-2).

In 1998/99, the tendency to be overweight increased with age among both men and women in the general population (Figure 3-3). This tendency is similar to that in previous years.

Figure 3.3: Increases in Overweight with Age

Proportion of overweight[1] adults in the general population by age group and sex, Canada, 1998/99.



	20-39 years	40-59 years
Women	30.1	43.7
Men	52.1	66.2

Sex and Age Group

[1]Overweight, BMI = 25.0+

Source: Statistics Canada, National Population Health Survey.

Physical Inactivity

Physical inactivity leads to a higher risk for the development of diabetes. The NPHS estimates energy expenditure during leisure time. Individuals who expended 1.5 kilocalories/kg or less every day were classified as physically inactive.

Among individuals with self-reported diabetes, 74.3% were overweight in 1998/99. The proportion of women with

In the general population, more women than men reported inactivity in 1998/99 (Figure 3-4). The proportions of

men and women who were physically inactive decreased between 1994/95 and 1998/99.

Of those individuals with self-reported diabetes, women were more likely than men to be physically inactive (Figure 3-5).

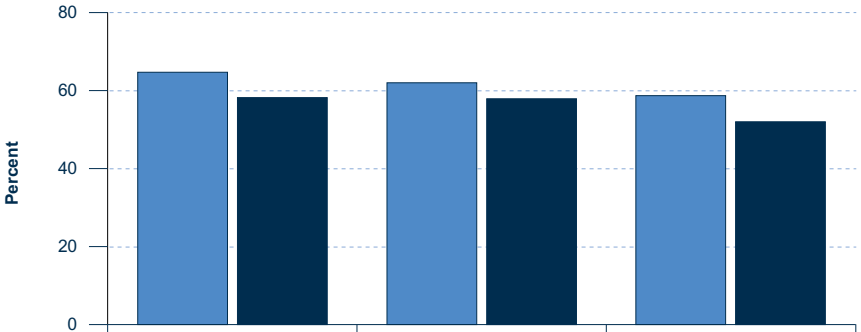
The difference, however, was not statistically significant.

Overall in 1998/99, 55.4% of the general population reported that they were physically inactive. Individuals with self-reported diabetes were more likely to be inactive (65.1%).

Among men and women in the general population, physical inactivity appeared to increase with age. The difference, however, was not statistically significant (Figure 3-6). This tendency is similar to that of previous years.

Figure 3.4: Proportion of Physically Inactive Adults in Canada

Proportion of physically inactive adults aged 20+ in the general population, Canada, 1994/95-1998/99.



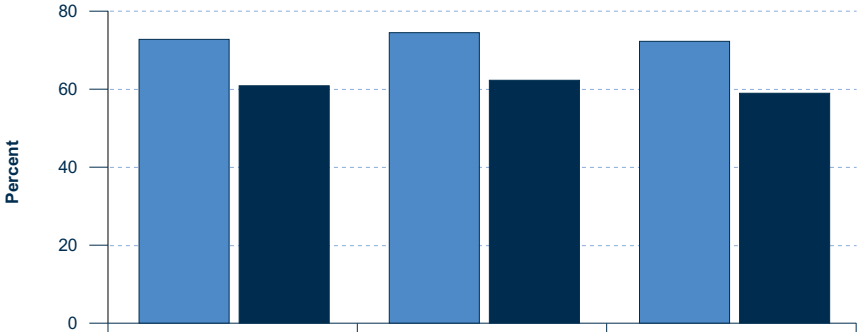
	1994/95	1996/97	1998/99
Women	64.7	62.0	58.7
Men	58.2	57.9	52.0

Sex and Year

Source: Statistics Canada, National Population Health Survey.

Figure 3.5: Physically Inactive Adults with Self-Reported Diabetes

Proportion of physically inactive adults aged 20+ years with self-reported diabetes, Canada, 1994/95-1998/99.



	1994/95	1996/97	1998/99
Women	72.8	74.5	72.3
Men	61.0	62.4	59.1

Sex and Year

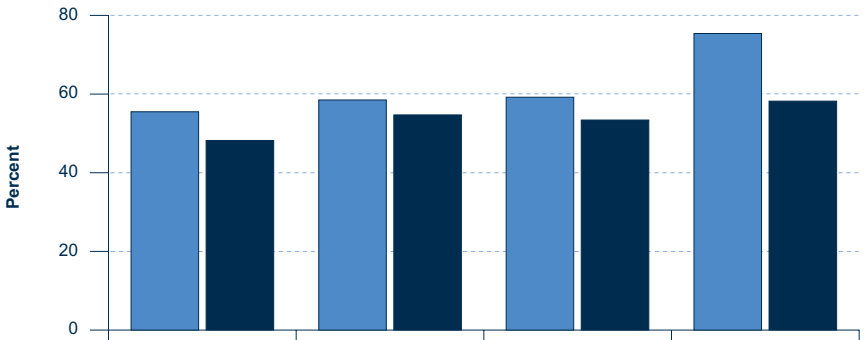
Source: Statistics Canada, National Population Health Survey.

Smoking

Cigarette smoking is a risk factor for the complications of diabetes. A daily smoker

Figure 3.6: Increases in Physical Inactivity with Age

Proportion of physically inactive adults in the general population by age group and sex, Canada, 1998/99.



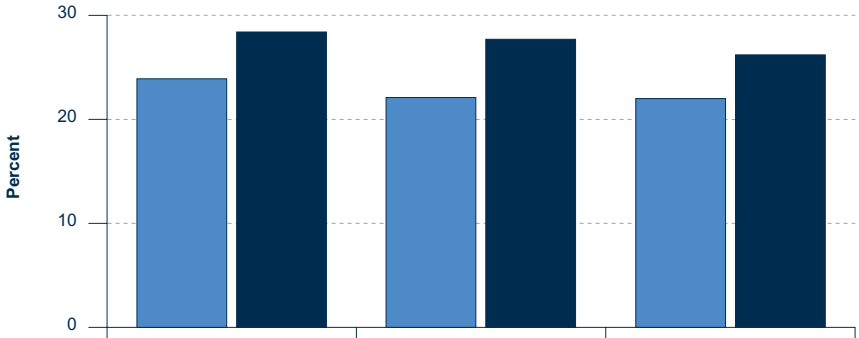
	20-39 years	40-59 years	60-74 years	75+ years
Women	55.5	58.5	59.2	75.4
Men	48.2	54.7	53.4	58.2

Age Group and Sex

Source: Statistics Canada, National Population Health Survey.

Figure 3.7: Proportion of Daily Smokers in Canada

Proportion of daily smokers aged 20+ years in the general population, Canada, 1994/95-1998/99.



	1994/95	1996/97	1998/99
Women	23.9	22.1	22.0
Men	28.4	27.7	26.2

Year and Sex

Source: Statistics Canada, National Population Health Survey.

was defined in the NPHS as an individual who was smoking cigarettes on a daily basis at the time of the interview.

The proportion of men in the general population who smoked decreased between 1994/5 and 1998/99 (Figure 3-7). The difference, however, is not statistically significant.

Although the proportion of men with diabetes who smoked appeared to decrease between 1994/95 and 1998/99 in a similar way to the general population, the trend is not statistically significant because of the small sample (Figure 3-8).

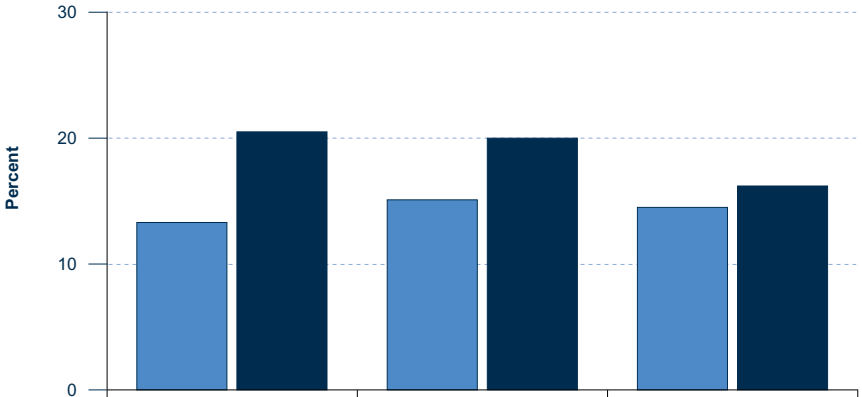
In addition, almost one-quarter (24.1%) of all Canadians aged 20+ years smoked daily, according to the 1998/99 NPHS. The proportion of smokers among individuals with self-reported diabetes was much lower than in the general population (15.4%); this may be due to a higher average age among diabetics than in the general population.

In 1998/99, the proportion of men and women who smoked in the general population was highest among those aged between 20 and 39 years and decreased with increasing age (Figure 3-9).

The differences among men, however, may have resulted from sampling, as the confidence intervals of the estimates for the age groups 20-39 and 40-59 overlap. This tendency is similar to that of the previous year.

Figure 3.8: Daily Smokers with Self-Reported Diabetes

Proportion of daily smokers aged 20+ years with self-reported diabetes, Canada, 1994/95-1998/99.



	1994/95	1996/97	1998/99
Women	13.3	15.1	14.5 *
Men	20.5 *	20.0	16.2

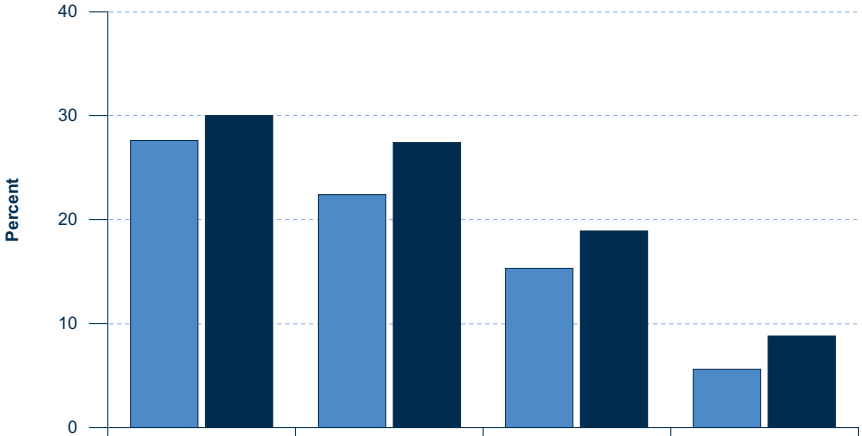
Sex and Year

* CV = 16.7 — 25.5

Source: Statistics Canada, National Population Health Survey.

Figure 3.9: Decreases in Daily Smoking with Age

Proportion of daily smokers in the general population by age group and sex, Canada, 1998/99.



	20-39 years	40-59 years	60-74 years	75+ years
Women	55.5	58.5	59.2	75.4
Men	48.2	54.7	53.4	58.2

Age Group and Sex

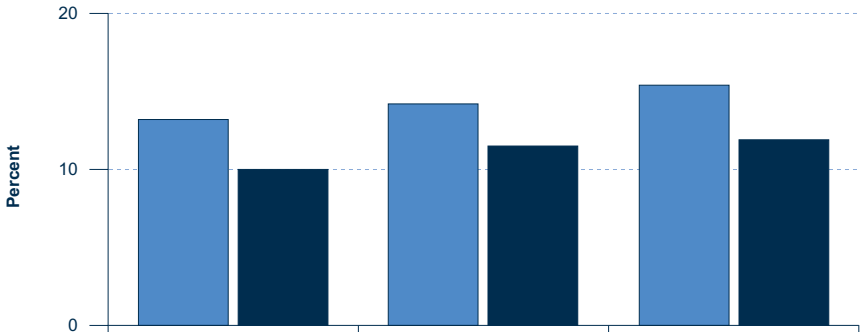
Source: Statistics Canada, National Population Health Survey.

High Blood Pressure

High blood pressure is also considered a risk factor for the complications of diabetes. An individual is considered to have high blood pressure when the physician-assessed diastolic pressure is > 90 mm Hg or systolic pressure is > 160 mm Hg (NPHS).

Figure 3.10: Proportion of Adults with High Blood Pressure in Canada

Proportion of adults aged 20+ in the general population with high blood pressure, Canada, 1994/95-1998/99.



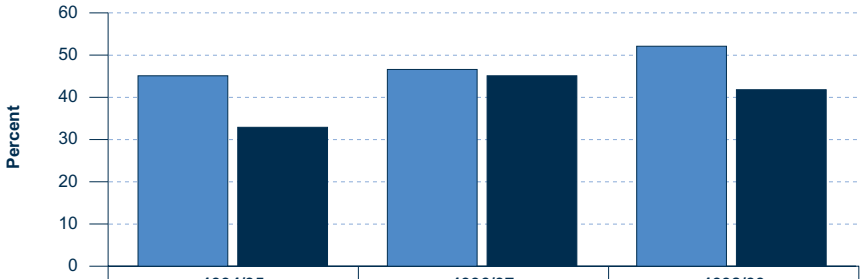
	1994/95	1996/97	1998/99
Women	13.2	14.2	15.4
Men	10.0	11.5	11.9

Sex and Year

Source: Statistics Canada, National Population Health Survey.

Figure 3.11: High Blood Pressure with Self-Reported Diabetes

Proportion of adults who have high blood pressure aged 20+ years with self-reported diabetes, Canada, 1994/95-1998/99.



	1994/95	1996/97	1998/99
Women	45.1	46.6	52.1
Men	32.9	45.1	41.8

Sex and Year

Source: Statistics Canada, National Population Health Survey.

In 1998/99, a higher proportion of women than men in the general population reported high blood pressure (Figure 3-10). This may be because women are more likely to have their blood pressure assessed. The proportion showed little change among three surveys.

The sample of those with diabetes was too small to determine any trend in high blood pressure over time or between men and women (Figure 3-11).

In an overall picture, 13.7% in the general population reported having high blood pressure, whereas nearly one-half of individuals with self-reported diabetes (46.5%) reported high blood pressure.

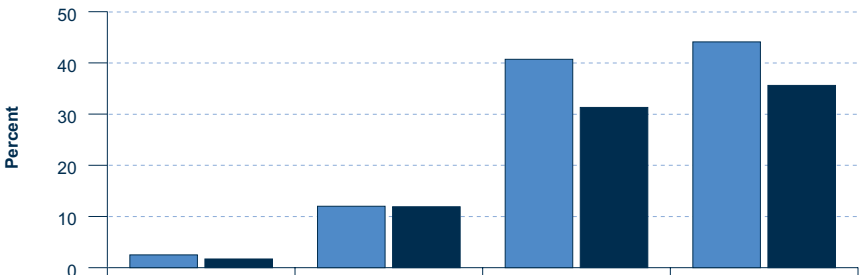
In 1998/99, among both men and women in the general population, the prevalence of high blood pressure increased with age (Figure 3-12). This tendency is similar to that of the previous year.

Summary of Findings

Risk factors for type 2 diabetes remain very common in both the general population and in people with diabetes. However, overweight and physical inactivity could be considered, in a general sense, as modifiable risk factors for developing diabetes, and daily smoking and high blood pressure could be seen mainly as risk factors for diabetes complications.

Figure 3.12: Proportion of Adults with High Blood Pressure in Canada

Proportion of adults aged 20+ in the general population with high blood pressure by age group and sex, Canada, 1998/99.



	20-39 years	40-59 years	60-74 years	75+ years
Women	2.5	12.0	40.7	44.1
Men	1.7	11.9	31.3	35.6

Age Group and Sex

Source: Statistics Canada, National Population Health Survey.

Regarding overweight, the proportion of men who are overweight seems to have increased over time, and this may partially explain the higher prevalence of diabetes among men than women. Unless this trend is reversed, it will have serious ramifications on the future prevalence of diabetes.

It is encouraging that both men and women are becoming more physically active in the general population. However, efforts to encourage regular physical activity must continue so that Canadians, in general, become less sedentary. Although physical inactivity is a risk factor for diabetes, it is also a risk factor for complications such as cardiovascular disease. Therefore, the high proportion of people with diabetes who are physically inactive is a matter of great concern.

Over the three surveys, the proportion of men and women in the general population who were daily smokers appeared to be decreasing. It is also encouraging that the proportion of smokers among individuals with diabetes is much lower than in the general population. However, this may be due to the fact that the diabetic population is older than the general population, and older Canadians are less likely to smoke.

The very high prevalence of reported high blood pressure among those with diabetes in all age groups is a cause for concern and at the same time a reassurance. The concern is that many individuals with diabetes are at high risk of cardiovascular and other complications due to high blood pressure. On the other hand, it is reassuring that those whose high blood pressure is detected can be treated to reduce the risk. The

effective control of high blood pressure can decrease the risk of cardiovascular disease complications[7].

Diabetes educational programs can assist individuals to adopt a healthy lifestyle with effective weight control, increased physical activity, and cessation of smoking. Smoking is the only lifestyle factor that is less common among those with diabetes than in the general population. Programs that encourage non-smoking and interventions by health providers may have made a significant impact on those with diabetes.

The lack of known modifiable risk factors for type 1 diabetes points to the need for further research in this area. To date, no known effective methods for preventing type 1 diabetes exist. Research is exploring the possibility of altering environmental factors in people who are genetically at risk by such methods as removing cow's milk protein from infant feeds. There is also research investigating the possibility of modifying the immune process in people with subclinical beta cell loss identified by positive screening tests, through the use of nicotinamide, oral insulin, and injected insulin[2].

References

1. Fantus IJ, Delovitch TH, Dupré J. *Prevention of diabetes mellitus: goal for the twenty-first century, part two*. Diabetes Care 1997;21(4):184-206.

2. Meltzer S, Leiter L, Daneman D, Gerstein H, Lau D, Ludwig S et al. *Clinical practice guidelines for the management of diabetes in Canada*. Can Med Assoc J 1998;39 (8:Suppl):S8.

3. Ford ES, Williamson DF, Liu S. *Weight change and diabetes incidence: findings from a national cohort of US adults*. Am J Epidemiol 1997; 146:214-22.

4. Resnick H, Valsania P, Halter J, Lin X. *Relation of weight gain and weight loss on subsequent diabetes risk in overweight adults*. J Epidemiol Community Health 2000;54: 596-602.

5. Statistics Canada. *Health care services – recent trends*. Health Reports 2000;11(4):91-109.

6. Pi-Sunyer FX. *Medical hazards of obesity*. Ann Intern Med 1993;119:655-60.

7. Meltzer S et al. S23.

CHAPTER 4

Health Outcomes

Introduction

This chapter focuses on the health outcomes of diabetes, measured as the quality of life of individuals with diabetes and premature death due to the disease. The concept of quality of life has multiple dimensions and could be related to physical well-being, social and economical stability, as well as emotional well-being[1]. Diabetes exerts a significant effect on the quality of life of those with the disease. The continuous need to monitor intake (in terms of timing, type and amount of food), take medication (whether pills or insulin injections), monitor blood glucose, and anticipate and plan for activities that may affect diabetes control can severely strain their daily lives. This is a particular challenge for children and youth with diabetes, who face the task of fitting in with their peers while coping with the demands of treatment.

Without good control of blood sugar, diabetes can cause life-threatening events, such as severe hypoglycemia (low blood sugar), hyperglycemia (high blood sugar), ketoacidosis and even coma. Self-management education focusing on monitoring and interpreting blood sugar results, taking and adjusting medication as needed, and adopting a healthy lifestyle (diet, physical activity, smoking cessation/avoidance, and stress management) plays a critical role in diabetes control. In the short term, good metabolic control (of sugars, lipids, and blood pressure) will both enhance the quality of life and decrease the use of acute care services. The long-term complications of diabetes affect many parts of the body, decrease quality of life for individuals with diabetes, and increase their use of health services. Those with diabetes may also face shortened life expectancy due to complications from the disease.

Self-Reported Health

The measurement of self-reported health in this chapter comes from the NPHS, in which individuals were asked to self-rate their health on a five-point scale. Responses in the categories "excellent", "very good" and

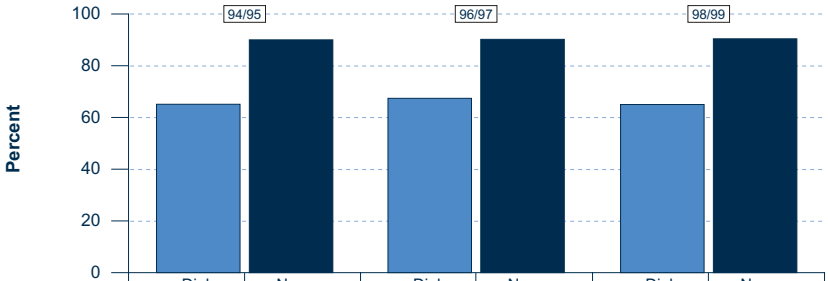
"good" were grouped into a category called "good or better". According to the 1998/99 NPHS, 64.5% of individuals with diabetes reported their health as good or better. The proportions were much lower than among those without diabetes (90.8%) ($p < 0.05$).

In 1998/99, the perception of good health was similar among both men and women with diabetes (Figures 4-1 and 4-2). The apparent increase in reported good health among women with diabetes between 1994/95 and 1998/99 was not statistically significant because of the small sample.

In 1998/99, perceived good health decreased with increasing age among men in both the diabetic and non-diabetic populations (Figure 4-3). The decrease appeared earlier among men with diabetes: the proportion with perceived good health among men aged between 40 and 59 years was very similar to that of men aged 75+ years without diabetes. A much lower proportion of men with diabetes aged 40-59 years reported good health, in comparison to their counterparts aged 20-39 years ($p < 0.05$).

Figure 4.1: Self-Reported Health Among Men With and Without Diabetes

Self-ratings of good or better health among men aged 20+ years with and without self-reported diabetes, Canada, 1994/95-1998/99.



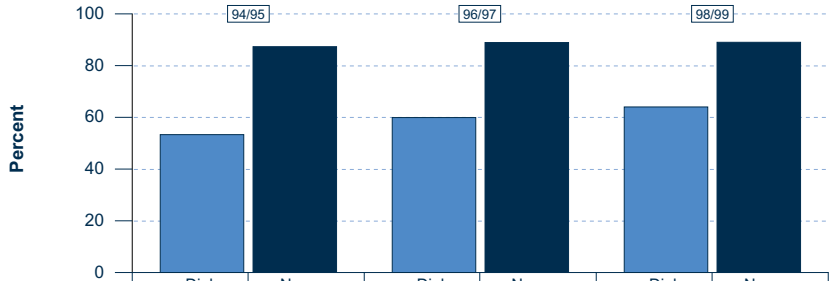
	Diab	Non	Diab	Non	Diab	Non
Good or better	65.1	90.0	67.4	90.2	65.0	90.4

Diab = Individuals with self-reported diabetes Non = Individuals without diabetes

Source: Statistics Canada, National Population Health Survey.

Figure 4.2: Self-Reported Health Among Women With and Without Diabetes

Self-ratings of good or better health among women aged 20+ years with and without self-reported diabetes, Canada, 1994/95-1998/99.



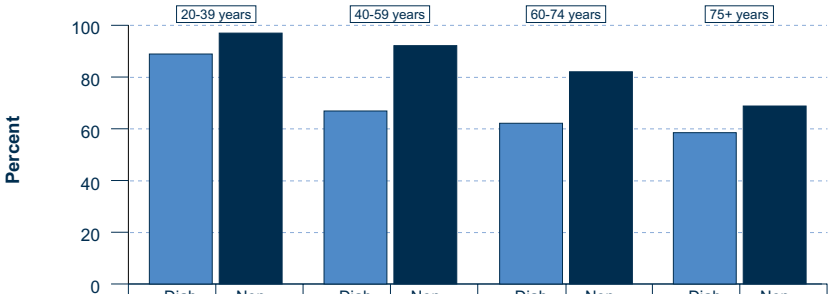
	Diab	Non	Diab	Non	Diab	Non
Good or better	53.3	87.3	59.9	88.9	64.0	89.0

Diab = Individuals with self-reported diabetes Non = Individuals without diabetes

Source: Statistics Canada, National Population Health Survey.

Figure 4.3: Self-Reported Health Among Men According to Age

Self-ratings of good or better health among men with and without self-reported diabetes according to age, Canada, 1998/99.



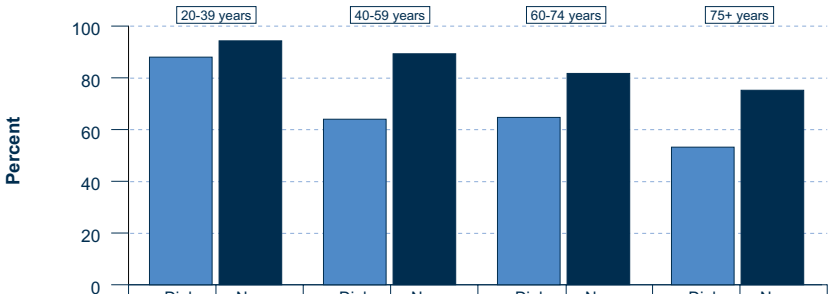
	Diab	Non	Diab	Non	Diab	Non	Diab	Non
Good or better	88.0	96.0	66.2	91.2	61.5	81.2	57.9	68.1

Diab = Individuals with self-reported diabetes Non = Individuals without diabetes

Source: Statistics Canada, National Population Health Survey.

Figure 4.4: Self-Reported Health Among Women According to Age

Self-ratings of good or better health among women with and without self-reported diabetes according to age, Canada, 1998/99.



	Diab	Non	Diab	Non	Diab	Non	Diab	Non
Good or better	88.0	94.3	64.0	89.3	64.7	81.7	53.2	75.2

Diab = Individuals with self-reported diabetes Non = Individuals without diabetes

Source: Statistics Canada, National Population Health Survey.

In 1998/99, perceived good health decreased dramatically among women with diabetes over the age of 40 years ($p < 0.05$). (Figure 4-4). The decrease in the non-diabetic population was more gradual.

Activity Restriction

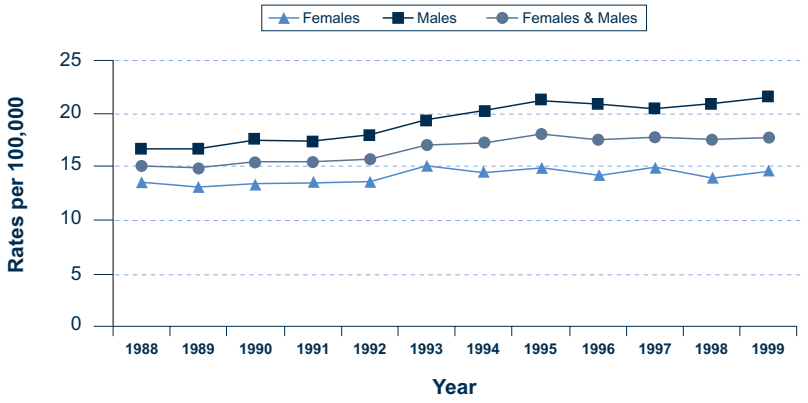
In 1998/99, individuals aged 20+ years with diabetes reported at least one day of activity restriction in the previous year more frequently than those without diabetes (17.3% versus 11.1%, $p < 0.05$). This difference was statistically significant among individuals aged 40-59 years (22.3% versus 10.6%, $p < 0.05$) and aged 60-74 years (17.6% versus 11.3%, $p < 0.05$). The sample in the younger age group (20-39 years) was too small to assess the difference between those with and without diabetes.

Mortality

Diabetes mortality data come from the Canadian Mortality File and only the leading cause of death has been considered. Mortality rates attributed to diabetes increased among both men and women in the early 1990s and have remained steady since 1995 (Figure 4-5).

Figure 4.5: Trends in Diabetes Mortality Rates

Diabetes mortality rates per 100,000 for all ages by sex, Canada, 1988-1999 (age-standardized to the 1991 Canadian population)



Source: Centre for Chronic Disease Prevention and Control, Health Canada, using Statistics Canada, Annual Canadian Mortality File

In 1999, 6,137 deaths in Canada were attributed to diabetes (2.6% of all deaths). Rates were higher among men than women (Table 4-1, Figures 4-6 and 4-7). Rates of mortality due to diabetes were low among individuals under the age of 60 years. In spite of low mortality rates, 70 people under the age of 40 years died as a result of diabetes, as did 580 between 40 and 59 years. However, the actual number of deaths due to diabetes may be much higher. The annual mortality file compiled by Statistics Canada includes only the underlying cause.

Table 4-1 Deaths Due to Diabetes by Age Group and Sex, Canada 1999

Age Group (years)	Deaths Due to Diabetes (Rate/100,000)					
	Females		Males		Females and Males	
	No.	Rate/100,000	No.	Rate/100,000	No.	Rate/100,000
0-19	3	0.1	3	0.1	6	0.1
20-39	29	0.6	39	0.8	68	0.7
40-59	178	4.3	402	9.8	550	7.0
60-74	758	42.9	1,102	68.9	1,860	54.1
75+	2,104	202.9	1,519	244.6	3,623	218.5
All	3,072	20.0	3,065	20.3	6,137	20.1

Source: Centre for Chronic Disease Prevention and Control, Health Canada, using Statistics Canada Mortality File

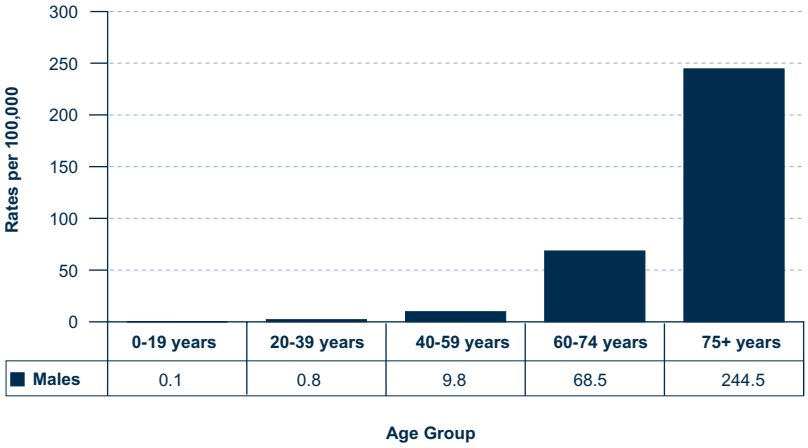
Using data from other studies, the true mortality rate related to diabetes is as much as five times higher than the rate calculated from the Statistics Canada mortality database[2]. Therefore, approximately 30,000 deaths (6,137 deaths in 1999 multiplied by 5) each year may be attributed to diabetes and diabetes-related complications.

Between 2000 and 2050, the number of deaths directly attributed to diabetes is estimated* to triple to almost 9,000 deaths per year among men and 8,500 among women (Figure 4-8).

* Projections based on applying the 1996/97 five-year age-specific rates to population projections to the year 2050.

Figure 4.6: Diabetes Mortality Rates in Males

Mortality rate for diabetes among males by age group, Canada, 1999.



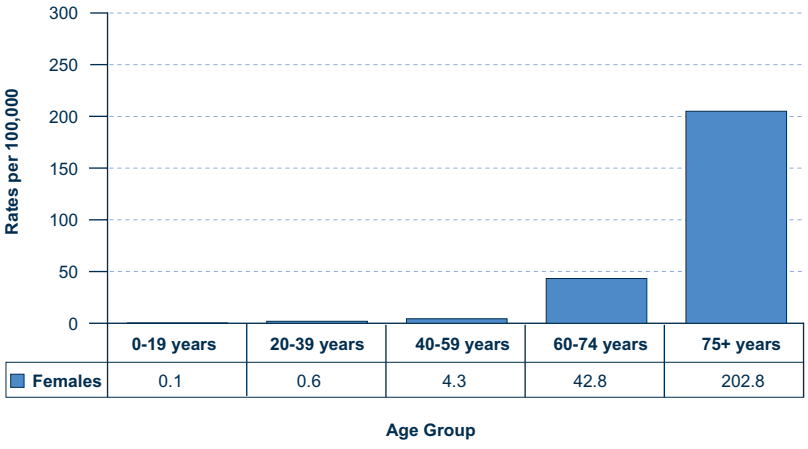
	0-19 years	20-39 years	40-59 years	60-74 years	75+ years
Males	0.1	0.8	9.8	68.5	244.5

Age Group

Source: Centre for Chronic Disease Prevention and Control, Health Canada, using Statistics Canada, Annual Canadian Mortality File.

Figure 4.7: Diabetes Mortality Rates in Females

Mortality rate for diabetes among females by age group, Canada, 1999.



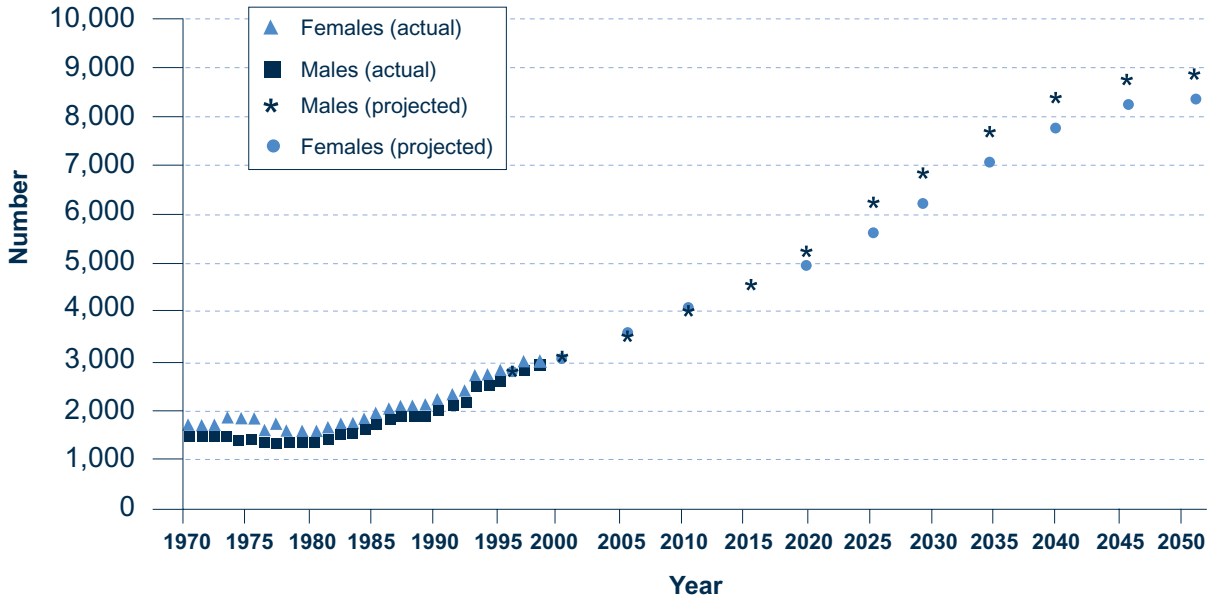
	0-19 years	20-39 years	40-59 years	60-74 years	75+ years
Females	0.1	0.6	4.3	42.8	202.8

Age Group

Source: Centre for Chronic Disease Prevention and Control, Health Canada, using Statistics Canada, Annual Canadian Mortality File.

Figure 4.8: Estimated Future Deaths from Diabetes

Number of actual and projected deaths due to diabetes by sex, Canada, 1970-2050.



Source: Statistics Canada, Annual Canadian Mortality File.

Summary of Findings

Individuals with diabetes are less likely than those without diabetes to report perceived good health. In addition, they more often report that they experience activity restriction. The negative impact of diabetes may be due to diabetes-related complications and/or the challenges associated with diabetes care.

The higher mortality rates associated with diabetes among men than women are consistent with the slightly higher prevalence of diabetes among men. In addition, men tend to develop cardiovascular disease complications, which carry a high mortality rate, more often than women.

Current mortality data compiled by Statistics Canada under-represent the contribution of diabetes to mortality in Canada. In a study by Statistics Canada of death certificates that mentioned diabetes, only 28% listed it as the underlying cause of death. The remainder listed diabetes-related complications, such as kidney failure or heart disease or stroke, as the underlying cause of death and listed diabetes as a contributing cause.

Mortality rates among those aged 75 years and over heavily influence the overall rates of diabetes mortality, as the rates in this age group are dramatically higher than among younger adults. The stabilization of mortality rates in this age group among both men and women has resulted in a levelling off of the overall mortality rates. Possible reasons for this trend include an increase in lifesaving procedures, advances in therapeutic and diagnostic technology, and a focus on reducing risk factors. The levelling off of the mortality rate may signal that people are living longer with diabetes, but doesn't necessarily mean that they have a higher quality of life.

This levelling off of mortality rates may mislead health planners into thinking that the diabetes problem has stabilized. In fact, the number of deaths will likely increase in the future among both men and women because the population is aging. These individuals will need a variety of health services in the acute, chronic and home care sectors for many years before death. Thus, coping with this increasing need for service requires immediate preparation, not only to address the current situation but to be effective for the next 20 years as well.

Full monitoring of the health outcomes or impact of diabetes on the lives of those with the disease will require additional data. It is anticipated that the NDSS will be able to provide data on the complications of diabetes. In addition, further refinement of existing data would enable analysis of health outcomes according to the type of diabetes (type 1 and type 2). Population surveys could also seek information regarding the quality of life of both individuals with diabetes and their families, exploring such issues as the need for time away from work or school, activity restriction, and the ability to fulfil family and social roles.

References

1. De Souza TT, Santini L, Wada SA, Vasco, CF, Kimura M. *The quality of life of diabetics*. Rev Esc Enferm USP 1997,31(10):150-64.

2. Health Canada. *Diabetes in Canada: national statistics and opportunities for improved surveillance, prevention, and control*. Ottawa: Health Canada, 1999: 27.

CHAPTER 5

Use of Health Services and Costs

Introduction

Individuals with diabetes require a variety of health services, not only for the control of their disease but also for the diagnosis and treatment of associated complications. Therapy for individuals with diabetes aims to control blood sugar, blood pressure and blood lipids levels, to reduce symptoms and the risk of complications[1], and to enhance the quality of life. Blood sugar levels can be controlled through diet and oral hypoglycemic drugs and/or by injections of insulin, combined with lifestyle modification (healthy eating, active living, smoking avoidance/cessation, and stress management). Pharmacologic interventions combined with these lifestyle modifications also form a necessary part of managing the complications of diabetes.

Meeting these treatment goals requires a range of health care services, including primary health care, emergency, hospitalization and rehabilitation services, and home care:

> Central to the DHC [diabetes health care] team is the person with diabetes and his/her family. Also at the core are the primary care physician (who may be a diabetes specialist), the diabetes medical specialist/endocrinologist/internist and diabetes educators (nurses and dietitians). If required, other professional and lay caregivers may be included in an expanded DHC team. These may be medical specialists (ophthalmologists, cardiologists, neurologists, nephrologists and obstetricians), other health professionals (other nurses and dieticians, social workers, psychologists and other mental health workers, pharmacists, chiropodists, podiatrists and optometrists), community and public health agencies and other health organizations[2].

Primary health care services also have a central role in the early detection of individuals with diabetes. It can take many years before a person develops symptoms sufficient to warrant a visit to a doctor for assessment specific to diabetes. Therefore, screening all high-risk individuals (such as those with a family history of diabetes, or those over the age of 45 years) can result in early diagnosis and treatment that improves outcome[3].

Hospital services are required to treat the advanced stages of the complications of diabetes, which include heart disease, stroke, kidney disease, and foot, eye and nerve problems. As a result, hospitalization data provide a picture of the more severe aspects of the disease. Hospitalization data in this report include cases in which diabetes was reported as one of the first eight reasons for hospitalization. This captures not only cases in which diabetes itself was the primary reason for the hospital stay but also those in which the complications of diabetes were important reasons for the stay.

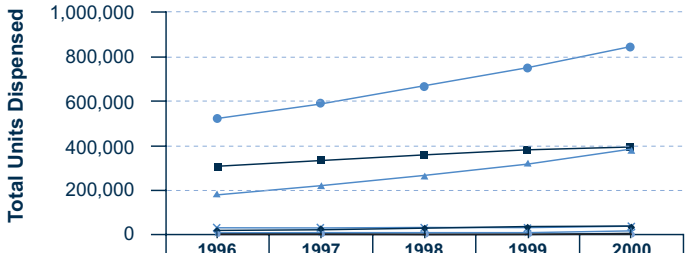
Living with diabetes is challenging because it affects every part of a person's life. Support from family, the multidisciplinary health care team, school, the workplace, and volunteer organizations such as the Canadian Diabetes Association can help individuals make the necessary adjustments towards improving the quality of their life.

Medication Use

Over three-quarters of individuals with diabetes (76.0%) use either insulin or oral anti-hyperglycemic agents (OAAs) (pills) to control their disease. Early in the course of the disease, most are able to use pills rather than insulin. Over time, however, as the disease progresses, treatment may require either insulin alone or insulin in combination with OAAs.

The total units of diabetes medications prescribed increased by 44% between 1996 and 2000 (Figure 5-1). This increase was primarily due to the increased use of biguanides and sulphonylureas.

Figure 5.1: Patterns in the Use of Diabetes Medications
Total Units of Diabetes Medications, by Year, dispensed annually, Canada (excluding the Territories), 1996-2000.

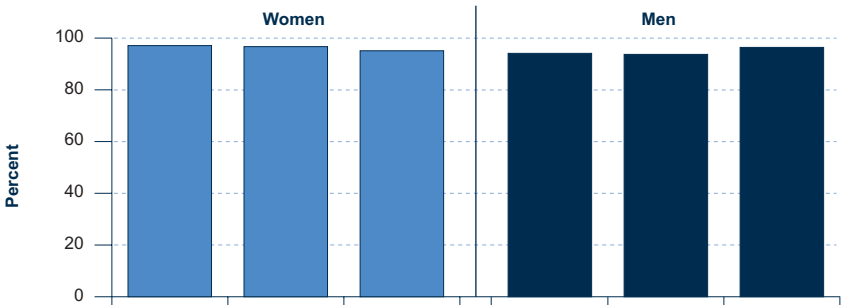


	1996	1997	1998	1999	2000
Total Units for Diabetes	528,896	594,227	672,543	756,958	847,790
Sulphonylureas	312,951	335,868	361,471	383,962	393,824
Biguanides	183,848	219,107	263,621	318,370	384,406
Insulins	29,087	30,914	33,584	35,094	36,851
Alpha-Glucosidase Inhibs.	2,964	8,209	13,799	18,395	18,683
Meglitinides	0	0	0	1,034	9,638
Thiazolidinediones	0	0	0	0	4,271
Others	46	130	68	103	116

Source: IMS HEALTH, Compuscript.

Figure 5.2: Blood Pressure Checks in Adults with Diabetes

Proportion of adults aged 20+ years with self-reported diabetes who had their blood pressure checked in the previous year, Canada, 1994/95-1998/99.



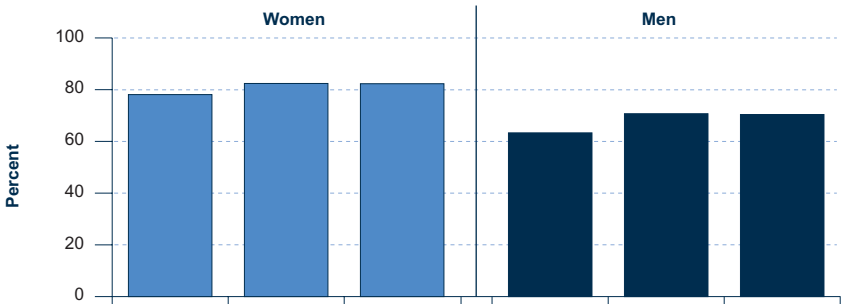
	Women			Men		
	1994/95	1996/97	1998/99	1994/95	1996/97	1998/99
BP Checked	97.1	96.7	95.1	94.1	93.7	96.4

Sex and Year

Source: Statistics Canada, National Population Health Survey.

Figure 5.3: Blood Pressure Checks in Adults, General Population

Proportion of adults aged 20+ years in the general population who had their blood pressure checked in the previous year, Canada, 1994/95-1998/99.



	Women			Men		
	1994/95	1996/97	1998/99	1994/95	1996/97	1998/99
BP Checked	78.1	82.4	82.3	63.3	70.7	70.4

Sex and Year

Source: Statistics Canada, National Population Health Survey.

Ambulatory Care Services

Blood Pressure Assessed

In 1998/99, according to the NPHS, almost all adults aged 20+ years with diabetes (95.8%) had had their blood pressure checked in the previous year. A high proportion of both men and women continued to have their blood pressure checked. This proportion remained steady between 1994/95 and 1998/99 (Figures 5-2 and 5-3).

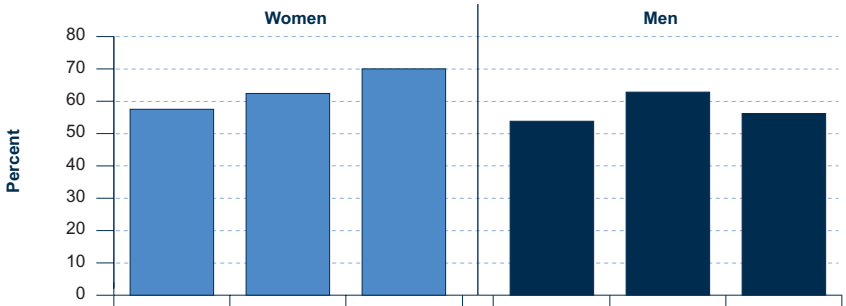
Eye Examination

It is recommended that individuals with diabetes have their eyes assessed regularly. Of all individuals with diabetes, 62.4% in 1998/99 reported having had an eye examination during the previous year. By that year, a higher proportion of women than men had had an annual examination. Whether this was for refraction or as assessment for diabetic retinopathy (eye disease that can lead to blindness) is unknown.

In 1994/95-1998/99 in the general population, women seemed slightly more likely to have had an eye examination in the previous year than men.

Figure 5.4: Eye Examination in Adults with Diabetes

Proportion of adults aged 20+ years with self-reported diabetes who had an eye examination in the previous year, Canada, 1994/95-1998/99.



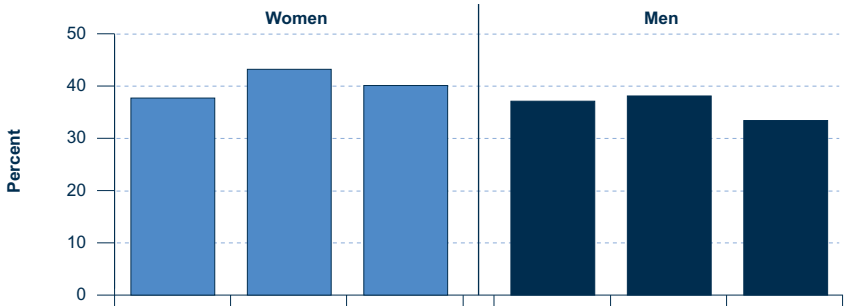
	1994/95	1996/97	1998/99	1994/95	1996/97	1998/99
Eye Exam	57.5	62.4	70.0	53.8	62.8	56.2

Sex and Year

Source: Statistics Canada, National Population Health Survey.

Figure 5.5: Eye Examination in Adults, General Population

Proportion of adults aged 20+ years in the general population who had an eye examination in the previous year, Canada, 1994/95-1998/99.



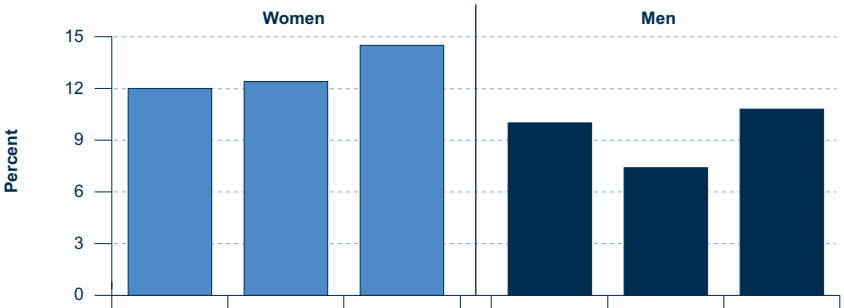
	1994/95	1996/97	1998/99	1994/95	1996/97	1998/99
Eye Exam	37.7	43.2	40.1	31.7	38.1	33.4

Sex and Year

Source: Statistics Canada, National Population Health Survey.

Figure 5.6: Home Care for Adults with Diabetes

Proportion of adults aged 20+ years with self-reported diabetes who had used home care in the previous year, Canada, 1994/95-1998/99.



	1994/95	1996/97	1998/99	1994/95	1996/97	1998/99
Home Care	12.0*	12.4	14.5	10.0*	7.4*	10.8*

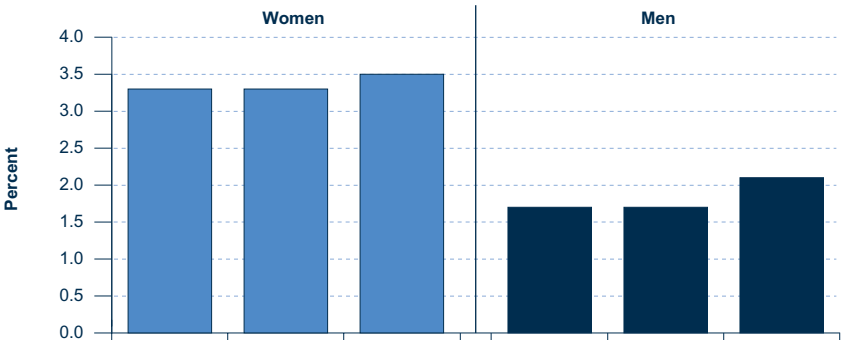
Sex and Year

* CV = 16.7-25.5

Source: Statistics Canada, National Population Health Survey.

Figure 5.7: Home Care for Adults, General Population

Proportion of adults aged 20+ years in the general population who used home care in the previous year, Canada, 1994/95-1998/99.



	1994/95	1996/97	1998/99	1994/95	1996/97	1998/99
Home Care	3.3*	3.3	3.5	1.7*	1.7*	2.1*

Sex and Year

* CV = 16.7-25.5

Source: Statistics Canada, National Population Health Survey.

Use of Home Care Services

According to the NPHS, a much higher proportion of individuals with diabetes used home care in the previous year than did the general population (12.5% compared with 2.8%). The highest use of home care was in the 75+ age group, in which 36.0% of those with diabetes used home care, as compared with 18.9% in the general population; in the 60-74 year-old age group the proportions were 10.0% versus 4.6% respectively.

Use of home care appeared to be more common among women than men with diabetes between 1994/95 and 1998/99. However, because of the small sample the differences were not statistically significant (Figure 5-6).

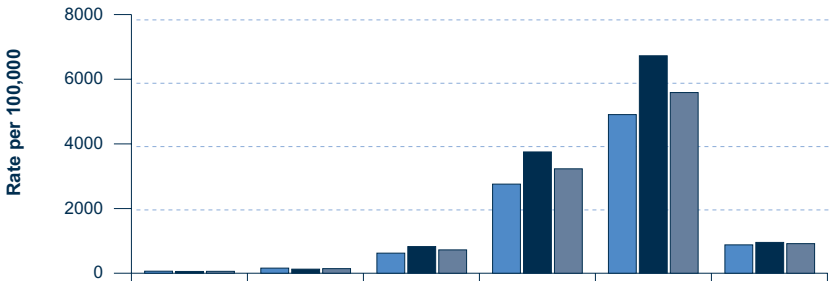
Hospitalization for Diabetes

Hospitalization data in this report include cases in which diabetes was reported as one of the first eight reasons for length of hospital stay. This captures not only cases in which diabetes itself was the primary reason for the hospitalization but also those in which the complications of diabetes were important reasons for the hospitalization.

In 1999/2000, there were 279,653 admissions for diabetes in Canada. Of all hospitalizations (excluding pregnancies), 9.3% listed diabetes among the first eight reasons for length of hospital stay, an increase from 8.6% in 1998/99. Please note that a diagnosis of diabetes that had been recorded in a patient's chart does not necessarily mean that diabetes was a significant factor in the hospitalization.

Figure 5.8: Hospitalizations with a Diagnosis of Diabetes

Rates of hospitalization with a diagnosis of diabetes by age group and sex, Canada, 1999/2000.



	0-19 years	20-39 years	40-59 years	60-74 years	75+ years	All ages
Females	63	158	621	2,756	4,906	877
Males	55	126	824	3,751	6,725	953
Females and Males	59	142	722	3,229	5,588	915

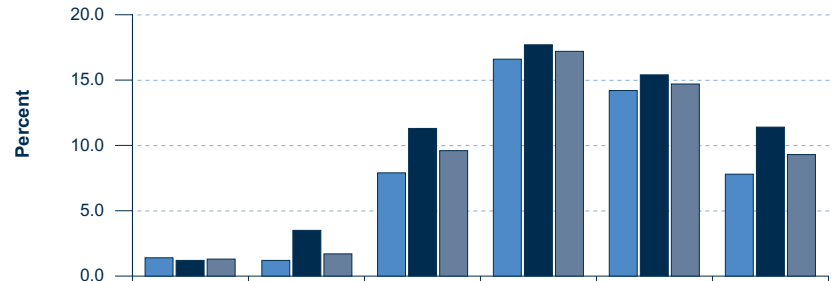
Age Group

* Diabetes listed among the first eight reasons for length of hospital stay.

Source: Centre for Chronic Disease Prevention and Control, Health Canada using data from Hospital Morbidity File, Canadian Institute for Health Information.

Figure 5.9: Proportion of Hospitalizations with a Diagnosis of Diabetes

Hospitalizations with a diagnosis of diabetes* as a proportion of all hospital admissions by age group and sex, Canada, 1999/2000.



	0-19 years	20-39 years	40-59 years	60-74 years	75+ years	All ages
Females	1.4	1.2	7.9	16.6	14.2	7.8
Males	1.2	3.5	11.3	17.7	15.4	11.4
Females and Males	1.3	1.7	9.6	17.2	14.7	9.3

Age Group

* Diabetes listed among the first eight reasons for length of hospital stay, pregnancy excluded from the denominator.

Source: Centre for Chronic Disease Prevention and Control, Health Canada using data from Hospital Morbidity File, Canadian Institute for Health Information.

In 1999/2000, rates of hospitalization for diabetes increased with age (Figure 5-8). Males aged 40 years and over had higher

Table 5-1 Hospitalizations Related to Diabetes

Age Group (years)	Hospitalizations related to diabetes as one of the first eight diagnoses by age group and sex, Canada, 1999/2000 (rate/100,000)					
	Females		Males		Females and Males	
	No.	Rate/100,000	No.	Rate/100,000	No.	Rate/100,000
0-19	2,442	63	2,248	55	4,690	59
20-39	7,221	158	5,901	126	13,122	142
40-59	25,853	621	34,065	824	59,918	722
60-74	48,780	2,756	60,131	3,751	108,911	3,229
75+	51,040	4,906	41,972	6,725	93,012	5,588
All	135,336	877	144,317	953	279,653	915

Source: Centre for Chronic Disease Prevention and Control, Health Canada, using data from Hospital Morbidity File, Canadian Institutes for Health Information

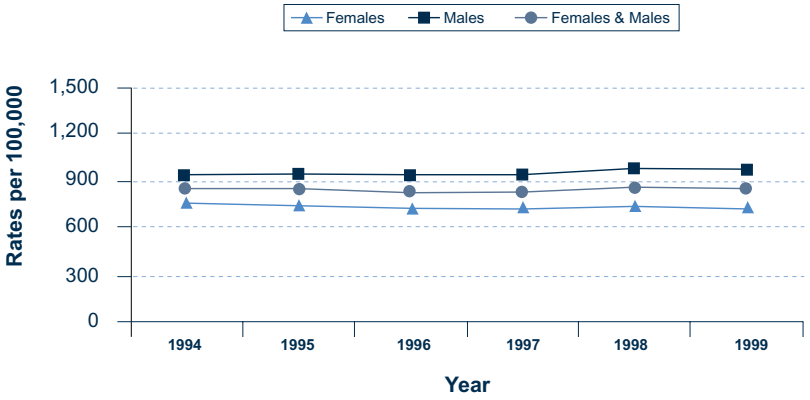
rates of hospitalization than females. Although the number of hospitalizations for diabetes was highest among those over the age of 60, 28% of diabetes-related hospitalizations in 1999/2000 were for individuals under the age of 60 years (Table 5-1).

In a high proportion of all hospitalizations of individuals over the age of 40 years, diabetes was listed among the first eight diagnoses (Figure 5-9). In 1999/2000, the contribution of diabetes to hospitalization was highest in the 60-74 year age group (17.2%).

Between 1994 and 1999, rates of hospitalization for diabetes among females decreased slightly while the rates among males increased. The net effect was little change in the overall hospitalization rate (Figure 5-10).

Figure 5.10: Trends in Hospitalizations with a Diagnosis of Diabetes Over Time

Rates of hospitalization for diabetes* among adults by sex, Canada (excluding the Territories), 1994/95-1999/2000 (standardized to the 1991 Canadian population)



Source: Centre for Chronic Disease Prevention and Control, Health Canada, using Statistics Canada, Annual Canadian Mortality File

Hospitalizations for Associated Conditions

Diabetes-related conditions include hypertension, cardiovascular disease, cerebrovascular disease, peripheral vascular disease, lower respiratory tract infection, renal disease, and skin disease.

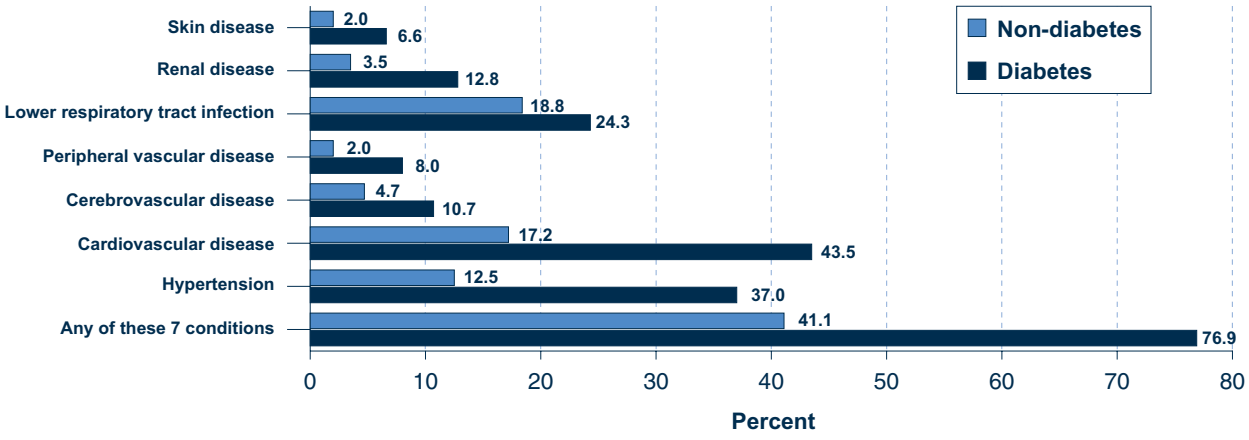
In 1999/2000, the proportion of hospitalizations with these conditions was consistently higher among individuals with diabetes (listed in the first eight diagnoses) than among individuals without diabetes (diabetes not listed in any of the diagnostic fields) (Figure 5-11). The most common comorbid conditions were cardiovascular disease (43.5%) and hypertension (37.0%).

Among individuals with diabetes, cardiovascular disease and peripheral vascular disease were more common among males than females as diabetes-related conditions contributing to hospitalization rates (Figures 5-12 and 5-13).

Hypertension was more common among females than males as a diabetes-related complication (40.7% versus 33.6%). These differences may be due to the different age structures of the respective populations.

Figure 5.11: Other Health Conditions Associated with Diabetes

Proportion of hospitalizations with health-related conditions of diabetes* among individuals with and without diabetes, Canada, 1999/2000.

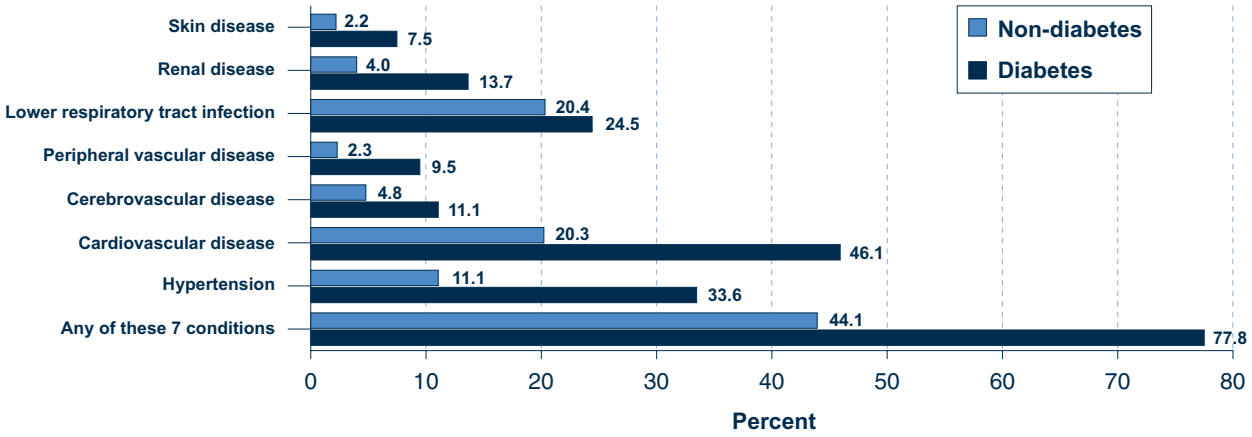


* Diabetes listed among the first eight reasons for length of hospital stay, pregnancy excluded from the denominator.

Source: Centre for Chronic Disease Prevention and Control, Health Canada using data from Hospital Morbidity File, Canadian Institute for Health Information.

Figure 5.12: Other Health Conditions Associated with Diabetes, Males

Proportion of hospitalizations with health-related conditions among males with and without diabetes, Canada, 1999/2000.

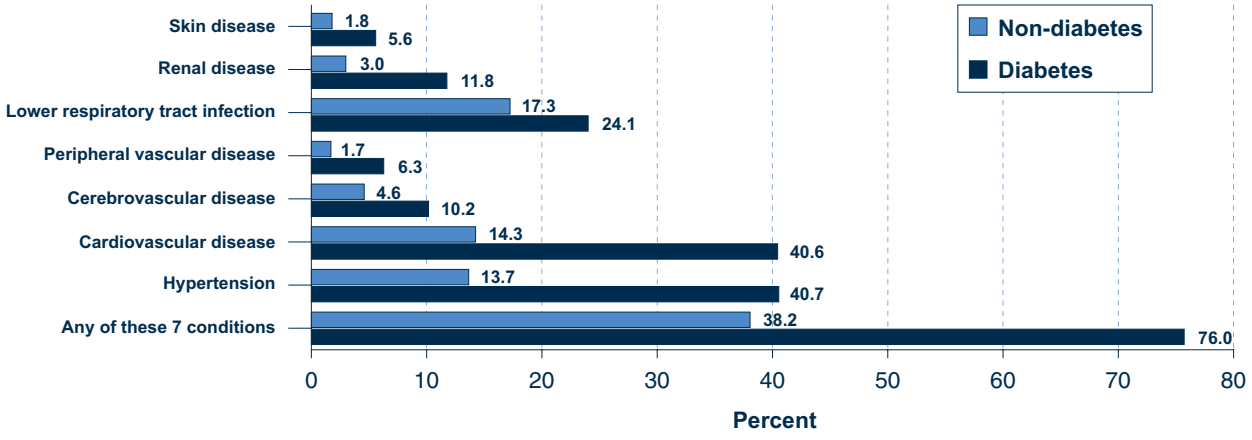


* Diabetes listed among the first eight reasons for length of hospital stay.

Source: Centre for Chronic Disease Prevention and Control, Health Canada using data from Hospital Morbidity File, Canadian Institute for Health Information.

Figure 5.13: Other Health Conditions Associated with Diabetes, Females

Proportion of hospitalizations with health-related conditions of diabetes* among females with and without diabetes, Canada, 1999/2000.



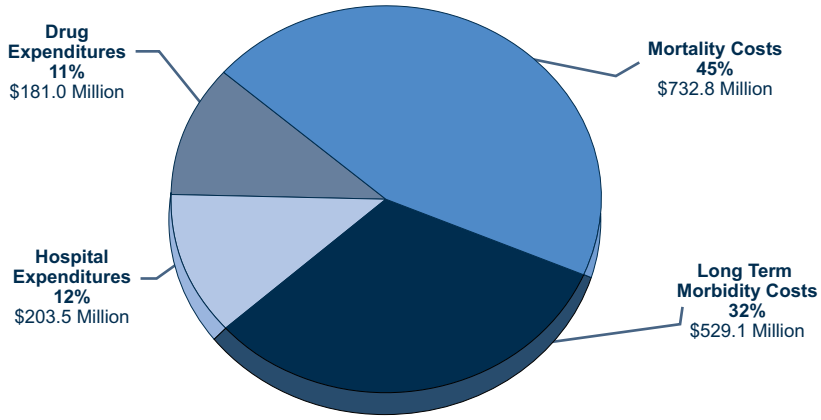
* Diabetes listed among the first eight reasons for length of hospital stay, pregnancy excluded from the denominator.

Source: Centre for Chronic Disease Prevention and Control, Health Canada using data from Hospital Morbidity File, Canadian Institute for Health Information.

Economic Burden of Diabetes in Canada

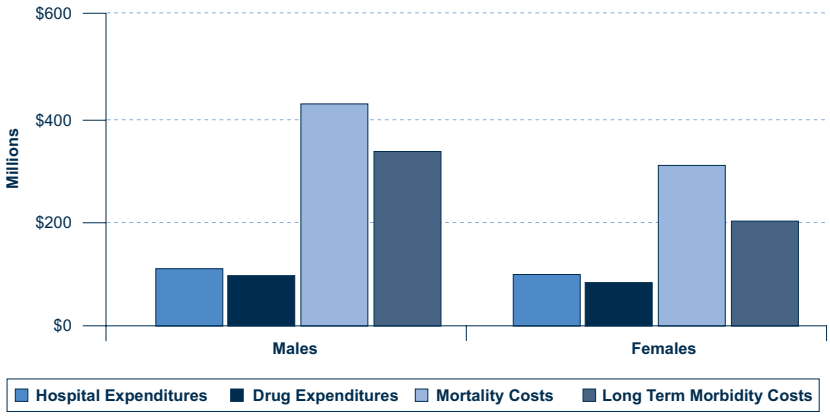
In Canada, the economic burden of diabetes alone is estimated at $1.6 billion in 1998; $0.4 billion (25%) in direct costs and $1.2 billion (75%) in indirect costs[4]. The relative magnitude of the major cost components is illustrated in Figure 5.14.

Figure 5.14: Economic Burden of Diabetes in Canada by Cost Component, 1998



Direct costs are defined as the value of goods and services for which payment was made and resources used in treatment, care and rehabilitation by governments (federal, provincial and territorial) as well as by individual Canadians. The direct cost estimate for diabetes includes only hospital care and drug expenditures, at $203.5 million, and $181.0 million, respectively.

Figure 5.15: Economic Burden of Diabetes in Canada*, by Sex and Cost Component, 1998



* Only 99.8% of drug expenditures could be distributed by sex.

Indirect costs refer to the dollar value of lost production due to illness, injury, disability or premature death. In terms of the principal indirect cost components that are estimated for diabetes in 1998, the value of lost production due to premature mortality represents the largest indirect cost at $732.8 million. The morbidity costs due to long-term disability represent $529.1 million.

Figure 5.15 illustrates the distribution of direct and indirect costs by sex and cost component. Overall, males account for

almost 60% ($963.2 million) of the total cost of diabetes in Canada. This is due to higher mortality and long-term disability costs for males as compared to females; $426.3 million and $331.3 million compared to $306.4 million and $197.8 million, respectively.

Seniors (65+ years) and individuals aged 35-64 years account for over 90% of the total diabetes cost. This represents $869.9 million and $653.9 million, respectively.

Although the economic burden of diabetes appears to have increased in Canada (in constant dollars) since 1993[5], these costs estimates are still considered to be conservative for several reasons:

- the definition of diabetes used refers only to diabetes mellitus (International Classification of Diseases, 9th revision – 250);
- the direct cost does not include physician care and research expenditures as well as the cost borne by patients or other payers (such as costs for transportation to health providers, and special diets);
- the indirect cost does not include morbidity costs due to short-term disability as well as the value of time lost from work and leisure activities by family members or friends who care for the patient; and
- all co-morbid effects are not taken into account.

A brief review of US studies is useful for comparison purposes[6]. Four US studies during the 1980s estimated the cost of diabetes to range from $17 to $23 billion annually (1990 US dollars). However, a 1992 US study published by the American Diabetes Association estimated costs at $91.8 billion annually when costs of illnesses associated with diabetes were included in the calculations[7]. For example, since diabetes is a risk factor for heart disease, the costs for a proportion of those with heart disease were attributed to diabetes. Given that the Canadian population is approximately one tenth the size of the US population and has roughly similar diabetes prevalence rates, the real economic cost of diabetes in Canada may be as high as $9 billion US annually (i.e. 10% of $91.8 billion).

While the diabetes cost estimates presented in this report should be interpreted in the context of the methods, assumptions and limitations from which they were calculated[4], they give an idea of the magnitude of the economic burden of diabetes in Canada.

Summary of Findings

The potential for improving the health of individuals with diabetes and for decreasing the overall costs of the disease to the health care system and community lies in directing action towards better control of the disease.

In the 1990s, diabetes care changed substantially with increased recognition of the importance of tight blood glucose control and diabetes self-management education. Several provincial ministries of health made a commitment to support diabetes education centres, bringing greater attention to the need to address risk factors such as high blood pressure and blood lipids, overweight/obesity, smoking, and stress. The 1990s also saw the production of better insulin, new classes of oral anti-hyperglycemic agents and improved technology for supporting better management.

The data on medication use support the nature of type 2 diabetes: that it can be controlled early in the course of the disease in some circumstances without the use of insulin. The increase in total units of hypoglycemic agents dispensed over time may be due to the high use among seniors, a segment of the population that is growing over time. This increase may also reflect the aggressive management of the disease with the use of medication to more closely control blood sugar, since type 2 diabetes is a progressive disease.

The control of high blood pressure is one of the most important preventive measures for reducing the complications of diabetes. The very high proportion of individuals with diabetes who have had their blood pressure checked in the past year is encouraging. Assessment is only the first step, however. It must be followed by adequate treatment through lifestyle changes and, where necessary, medication.

The higher use of home care services among seniors with diabetes compared with the general population of seniors attests to the disability that results from the complications of the disease. As with hospitalizations, the aging of the population will increase the need for home care services in the future.

The higher hospitalization rate among men than women may reflect the higher rate of cardiovascular complications among men. The lack of a decrease in hospitalization rates for diabetes in any age group contradicts the hospitalization rate in general, which has shown a steady decrease in the past several years. This may signal that the level of serious health problems among individuals with diabetes has not decreased. It also attests to continued pressure on hospital budgets.

Assessing the costs of diabetes still represents a major issue, and many challenges must be tackled. In fact, the EBIC (*Economic Burden of Illness in Canada, 1998*) estimate is a very conservative one and does not include physician costs. In addition, the hospital costs include only the leading cause of hospitalization, and this results in an underestimation of the real burden of diabetes essentially because the

complications of diabetes are not captured. Further research is needed to fill the various gaps that exist in assessing the economic burden of diabetes in Canada.

Monitoring the use of health services by individuals with diabetes requires additional information. As it matures, the NDSS will provide many of these data. Additional information is also needed on the use of diabetes education centres.

References

1. Meltzer S, Leiter L, Daneman D, Gerstein H, Lau D, Ludwig S et al. *1998 clinical practice guidelines for the management of diabetes in Canada*. Can Med Assoc J 1998;39 (8:Suppl):S9.

2. Meltzer et al, S3

3. Meltzer et al, S8.

4. Health Canada. *Economic Burden of Illness in Canada, 1998*. Catalogue. No. H21-136/1998, Ottawa, 2002.

5. Moore R, Mao Y, Zhang J, Clarke K. *Economic Burden of Illness in Canada*, 1993. Ottawa: Canadian Public Health Association, 1997.

6. National Institutes of Health. *Diabetes in America*. 2nd Edition. MIM Publication No. 95-1468. Bethesda, Maryland,1995.

7. American Diabetes Association. *Direct and Indirect Costs of Diabetes in the United States in 1992*. Alexandria, Virginia, 1993.

CHAPTER 6

Diabetes in Aboriginal Communities

Introduction

This chapter gives a summary of diabetes and its repercussions among Aboriginal people in Canada. It is important to mention that many sub-populations are included in the Aboriginal communities and, in this report, they can be divided into four (4) groups: On-reserve First Nations, Off-reserve First Nations, Métis and Inuit. We focus on all these groups, although limited data exists on Métis and Inuit people. Much of the essential information presented in this chapter come however from the report "Diabetes Among Aboriginal People in Canada: The Evidence"[1].

Diabetes is a very important issue in the Aboriginal communities for a variety of reasons:

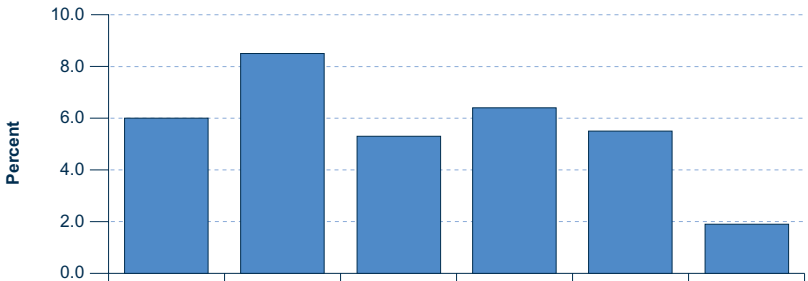
- High rate of disease and earlier onset;
- Late detection or diagnosis leading to greater severity at diagnosis;
- High rates of complications;
- Lack of accessible services;
- Increasing prevalence of risk factors for a population already at risk;
- Prevalence of diabetes among First Nations is now at least three times the national average;
- Most Aboriginal people with diabetes are women;
- Diabetes is now considered an epidemic in the Aboriginal communities.

Prevalence

Many surveys have been conducted at the national level since the 1990's but only two of them give an estimation of the prevalence of diabetes (self-reported) in each of the Aboriginal sub-populations.

The Aboriginal Peoples Survey (APS 1991) is the most recent comprehensive survey across Canada. According to this survey (Figure 6-1), the prevalence of diabetes among native groups in Canada is as follows: 8.5 % of North American Indian peoples on Indian reserves and settlements; 5.3% of North American Indian peoples off reserves; 5.5% of Métis people and 1.9% of Inuit people. Of the Aboriginal population represented in this survey, approximately 783,980 identified as North American Indian, 212,650 as Métis and 49,255 as Inuit. Approximately two-thirds of the First Nations people with a diagnosis of diabetes are women, which is different from the overall trend of the general population[2].

Figure 6.1: Crude Prevalence of Self-Reported Diabetes from the Aboriginal Peoples Survey, 1991



	Total Aboriginal	On-Reserve First Nations	Off-Reserve First Nations	Total First Nations	Métis	Inuit
Prevalence	6.0	8.5	5.3	6.4	5.5	1.9

Note: Based on Statistics Canada (1993) report.

The prevalence rate for all age groups from the First Nations and Inuit Regional Health Survey (FNIRHS 1997) are 20% greater than the Aboriginal Peoples Survey (APS). Among First Nations on reserve, the overall prevalence is 12% and one in four individuals who are over the age of 45 have diabetes. The age-standardized prevalence of diabetes for First Nations people is 3 to 5 times that of the general population[5].

Various local studies on the prevalence of diabetes among Aboriginal people in Canada have also been conducted in the last two decades. They have shown extremely high rates of diabetes, especially among some specific First Nations communities. For instance, rates among women age 35+ were between 22% and 48% in two Algonquin communities in Quebec and in Haida Gwaii (B.C), 17% of adults over age 35 had type 2 diabetes[3,4]. However, the methodologies used in these studies varied considerably and no single set of diagnostic criteria was identical.

Gestational diabetes is also an issue in the Aboriginal communities. According to the First Nations and Inuit Regional Health Survey, about 30% of women with diabetes reported that their diabetes was first diagnosed during pregnancy[5].

Overall, diabetes among Aboriginal people at least three times that of the population. Prevalence is expected to increase over time as a function of incidence, survival of people with diabetes, and aging of the population[5]. Inuit people are the only exception and their prevalence rates are below the national average. However, the latest indications are showing an increase of diabetes rates among this group[6].

Due to the self-reported nature of diabetes (respondents were asked if they have been diagnosed with diabetes by a health physician) and the non-inclusions of some reserves in the current surveys, the existing numbers probably understate the true prevalence of diabetes.

Risk Factors

Diabetes is a chronic disease with multifactorial causes involving the interactions of genetic susceptibility and environmental factors. Many of the risk factors tend to be worse in the Aboriginal communities for a variety of reasons. Aboriginal peoples are likely to be genetically predisposed to store energy from the diet very efficiently, due to the nomadic lifestyle of their ancestors. Patterns of dietary change, from traditional food to a diet high in energy, saturated fat and simple sugars, have been observed in many Aboriginal communities[1]. Briefly, the problem can be summarized as the adoption of a market diet high in energy, saturated fat and simple sugars, along with an increased tendency towards sedentary lifestyles and reduced activity, all of which leads to a rise in the prevalence of obesity and increased risk of diabetes[1].

Many studies have documented an increasing prevalence of obesity within Aboriginal communities over a few decades. For example, among the community of St. Theresa First Nations showed close to 50 % of the children were clinically obese[7]. The First Nations and Inuit Regional Health Survey indicated that 36 % of women and 26 % of men in Labrador were found to be overweight[5].

Lack of physical activity is an important risk factor for diabetes and the decline in physical activity often accompanies the transition to a more sedentary lifestyle[8]. Several studies show that Aboriginal people are less likely than non-Aboriginal people to exercise in a regular basis and are less likely to participate in leisure-time activity[2,9].

Complications

Diabetes is associated with many severe complications, which are related to various chronic diseases. These long-term complications seem to be more frequent in the Aboriginal communities than in the general population and make diabetes an important public health problem in these communities.

The following table summarizes important findings of the latest studies on complications among Aboriginal people. However, more research is needed as gaps still exist in the literature about all types of complications.

Type of complication	Main results
Heart problems	• First Nations men and women on-reserve have approximately three times the rate of heart problems and hypertension compared to the general Canadian population[5]. • A study at Kahnawake (First Nations) found that 13% of people with diabetes had strokes, versus just 3% of a comparable group of people without diabetes – an odds ratio of 4.5[10]. • The same study also found that half of those with diabetes had significant heart disease leading to heart attacks and coronary bypass surgery[10].
Lower limb amputations	• In the Manitoba study of First Nations, 91% of all lower limb amputations among First Nations are among people with diabetes[11]. • In a study done among Native Americans in Oklahoma, the mean age of first amputations was 6.6 years post diagnosis. Also, the 5-year survival rate after first amputation was only 40%[12].
Diabetic nephropathy	• The prevalence of diabetic nephropathy is much higher in First Nations than in the general population and the rates range from 25-60% following 15 to 20 years with diabetes[13]. • Aboriginal people are at increased risk of developing end-stage renal disease (ESRD) and the risk of ERSD due to diabetes specifically was at least 3 times higher than Canadian nationally[14]. • For those Aboriginal people who develop ESRD, the relative risk of being on dialysis is 6.5 times that of a non-aboriginal patients[11].
Disorders of the eyes	• A study done by Ross and Fick (1991) identified a high prevalence of serious untreated diabetic retinopathy in both insulin-using and non-insulin-using Aboriginal patients in southern Alberta[15]. • In the Kahnawake reserve (First Nations), 25 % of patients had retinopathy after 10 years of the disease[10].
Overall complications	• A study among Mohawks with diabetes found that over 60% had at least one major complication. In addition, the risk of having such complications was six (6) times that experienced by individuals without diabetes, even after adjusting for differences in age, sex, and the level of smoking, hypertension and obesity[10].

Use of health services

According to the Aboriginal Peoples Survey (APS 91), 67% of North American Indians, 72% of Métis and 47% of Inuit people saw a general practitioner in the previous year (for all causes)[2]. All of these rates are below the general population, which is an average of 82%.

The First Nations and Inuit Regional Health Survey (FNIRHS 97) indicated that usually less than 40% attend diabetes clinics or receive diabetes education[2]. The availability of health services could have an impact on hospitalizations and health care utilization.

There is a lack of information on the cost of diabetes among Aboriginal people. We found one study that addressed that issue and estimated the cost of diabetes among status Indians in Manitoba[16]. After adjusting for age, results indicated that the per-person annual cost for Status Indians with diabetes was $3,657, compared to $2,169 per person for the general population with diabetes. In addition, it was estimated that the cost of providing health care services to the entire status Aboriginal population of Manitoba was $46.5 million.

Discussion

The high prevalence of diabetes among Aboriginal, the greater severity at diagnosis and the high rates of complications are several reasons that show the importance of tackling diabetes in all Aboriginal communities. In addition, several risk factors have an enormous impact on diabetes among the Aboriginals and worsens the disease for a population already at risk.

Diabetes is associated with many severe complications, which are related to various chronic diseases. Such complications affect the circulatory system, eyes, kidneys, periodontal and nervous systems and may result in premature mortality, disability and compromised quality of life.

Among Aboriginals, the overall prevalence of diabetes and its complications are expected to increase in the next years and would represent a huge burden for health authorities. A study done in Manitoba shows the magnitude of this problem. It estimated that between 1996 and 2016, there will be a 10-fold increase in the rate of cardiovascular disease; a 5-fold increase in strokes, 10 times as many dialysis starts; 10 times the rate of lower extremity amputations; and 5 times the rate of blindness[17].

The difficulties in obtaining data on the prevalence and incidence of diabetes highlight the need for an on-going comprehensive surveillance system. The National Diabetes Surveillance System addresses the critical information gaps regarding diabetes in Canada. The goal of NDSS is to develop a national standardized database for diabetes surveillance with long-term monitoring for diabetes-related complications.

References

1. Health Canada. (2000), *Diabetes Among Aboriginal (First Nations, Inuit and Métis) People in Canada: The Evidence*. Health Canada.

2. Statistics Canada. (1993). *1991 Aboriginal Peoples Survey : Language, Tradition, Health, Lifesyle and Social Issues*. Ottawa: Statistics Canada. (Cat.No. 89-533).

3. Delisle, H.F., Ekoé, J.M. (1993). *Prevalence of non-insulin-dependant diabetes mellitus and impaired glucose tolerance in two Algonguin communities in Québec*. CMAJ, 148:41-47.

4. Grams, G. & al. (1996). *Haida perspectives on living with non-insulin-dependent diabetes*. CMAJ, 155: 1563-8.

5. First Nations and Inuit Regional Health Survey National Steering Committee. (1999). *First Nations and Inuit Regional Health Survey National Report*. ISBN 0-9685388-0-0.

6. Centre for Chronic Disease Prevention and Control, Health Canada, using data from National Population Health Survey (1996-97), Statistics Canada.

7. Dean, H. (1998). *NIDDM-Y in first Nations children in Canada*. Clin Pediatr, 37: 89-96.

8. Thouez, J.P., Rannou, A., Foggin, P. (1989). *The other face of development: native population, health status and indicators of malnutrition – the case of the Cree and Inuit in northen Quebec*. Soc Sci Med, 29: 965-74.

9. Imrie R. and Warren R. (1988). *Health promotion survey in the Northwest Territories*. Can J Public Health, 79: 16-24.

10. Macauley, A.C., Montour, L.T., Adelson, N. (1988). *Prevalence of diabetic and atherosclerotic complications among Mohawk Indians of Kahnawake, PQ*. CMAJ. 139: 221-4.

11. Manitoba Health. (1997). *Epidemiology of diabetes in First Nations*. Epidemiology and Diabetes Units, Manitoba Health.

12. Lee, J. & al. (1993). *Lower extremity amputation : incidence, risk factors, and mortality in the Oklahoma Indian Diabetes Study*. Diabetes, 42:876-82.

13. Whiteside, C. (1994). *Diabetic nephropathy: successful treatment depends upon early diagnosis*. Diabetes News, 2:1-3,8.

14. Young, TK & al. (1989) *Excessive burden of end-stage renal disease among Canadian Indians: a national survey*. Am J Public Health, 79:756-758.

15. Ross, AS & Fick, GF. (1991). *Insulin as a risk factor for diabetes complications*. Diabetes, 40(Suppl, 1): 333A (Abstract).

16. Jacobs, P. (1998). *Cost of diabetes in the status Indian population of Manitoba, 1995/96*. Draft document prepared for Medical Services Branch, Health Canada.

17. Green, C. & Al. (1997). *Projecting future diabetes prevalence in Manitoba First Nations*. 4th International Conference on Diabetes and Aboriginal People, San Diego.

APPENDIX A
Glossary

Activity Restriction

In the NPHS, activity restriction is defined as at least one day of activity restriction in the previous year.

Age-Specific Rate

The death or disease rate for a specified age group in a specified period. Five-year age groups are commonly used.

Age-Standardized Rate

An adjusted rate that represents what the crude rate would have been in the study population if that population had the same age distribution as the standard population, which in this report is the 1991 Canadian population. However, because standardization produces a summary measure, it may obscure important differences in age-specific patterns. Also, standardized rates can be compared with each other only when the same standard population has been used to obtain the rate.

Body Mass Index (BMI)

Anthropometric measure, defined as weight in kilograms divided by the square of height in metres. This measure correlates closely with body density and thickness (see Overweight).

Cardiovascular Disease

ICD-9 codes # 410-414, 428, 429.2, 429.3, 429.9

Cerebrovascular Disease

ICD-9 codes # 430-438

Coefficient of Variation

The coefficient of variation (CV) indicates the quality of a population estimate. A CV of 16.7-25.5 indicates moderate sampling variability. A CV of 25.6-33.3 indicates high sampling variability. Estimates with either a moderate or high CV should be interpreted with caution. In some situations, the sample in the survey was too small to produce a reliable estimate. These numbers are not included in the report.

Confidence Interval

The 95% confidence intervals (CIs) of all estimates were calculated during the preparation of the report. As a result, there is a 95% probability that the true value for the population lies somewhere in this range of values. If the text reports a difference between two values, the 95% CIs of these estimates do not overlap, and one can be reasonably sure that a true difference exists. If the text does not report on a difference found in the values, the reader should assume that none exists.

Cumulative Incidence

The number or proportion of a group who experience the onset of a health-related event during a specified time interval; this interval is generally the same for all members of the group, but, as in lifetime incidence, it may vary from person to person without reference to age.

Daily Smoker

An individual who was smoking cigarettes on a daily basis at the time of the interview.

Deaths – Projected

Five-year age-specific mortality rates for 1996/97 were applied to the projected population structure to the year 2050, developed by Statistics Canada.

Diabetes Mellitus (DM)

A chronic condition that results from the body's inability to sufficiently produce and/or properly use insulin.

Type 1 Diabetes

Type 1, also known as insulin dependent diabetes, occurs mainly in childhood or early adolescence and requires daily insulin injections for survival. The most common form is caused by the destruction of beta cells in the pancreas by the auto-immune system, leaving the pancreas unable to produce insulin.

Type 2 Diabetes

Type 2, also known as non-insulin dependent diabetes, typically occurs after the age of 40 years. A resistance to insulin develops, often exacerbated by excess weight, leaving the pancreas unable to produce enough insulin to compensate.

Gestational Diabetes

During pregnancy, some women develop glucose intolerance that can be treated with diet and/or insulin. If the glucose intolerance is not well controlled, however, the fetus can develop macrosomia (large size) that affects both the health of the baby and the birth.

Health-related Conditions of Diabetes

Diabetes-related conditions include hypertension, cardiovascular disease, cerebrovascular disease, peripheral vascular disease, lower respiratory tract infection, renal disease, and skin disease.

High Blood Pressure

High blood pressure, as defined by a physician, is usually considered to be a diastolic pressure of > 90 mm Hg or systolic pressure of > 160 mm Hg.

Hypertension (also called High Blood Pressure)

ICD-9 codes # 401-405

ICD-9 Codes

International Classification of Disease, 9th edition.

Incidence Rate

The rate at which new events occur in a population. The numerator is the number of new events that occur in a defined period; the denominator is the population at risk of experiencing the event during this period, sometimes expressed as person-time.

Insulin

A hormone secreted from beta cells in the pancreas, which assists with the conversion of glucose into energy.

Life Expectancy

Life expectancy is a summary measure of the health status of a population. It is defined as the average number of years an individual of a given age is expected to live if current mortality rates continue to apply.

Lower Respiratory Tract Infection

ICD-9 codes # 466, 480-487, 490-496, 500-519

Mortality Rate

An estimate of the portion of a population that dies during a specified period. The numerator is the number of people dying during the period; the denominator is the number in the population, usually estimated as the midyear population.

Mortality Data

Mortality or death data are collected by the provincial registrar of vital statistics for people resident in that province or territory at the time of death and are sent to Statistics Canada for final editing.

The death registration covers all deaths of Canadians occurring in Canada and to some extent in the United States. Deaths occurring in countries other than Canada and the United States are not covered.

Overweight

Body Mass Index (BMI) equal to or greater than 25 kg/m2 for men and women.

Peripheral Vascular Disease

ICD-9 codes # 440, 443, 459.8, 459.9

Physical Inactivity

An energy expenditure equal to or below 1.5, a level considered equivalent to leisure activity. Energy expenditure was calculated using the frequency and time per session of the physical activity as well as its MET value. The MET is a value of metabolic energy cost expressed as a multiple of the resting metabolic rate, obtained from a table provided by Statistics Canada. Thus, an activity of 4 METS, e.g., bicycling, requires four times the amount of energy needed when the body is at rest.

EE (kcal/kg/day) = x[(Ni *Di MET)/365]

where:

N = number of time respondents engaged in an activity (i), over a 12-month period;

D = the average duration in hours of the activity (i);

MET = the energy cost of the activity, expressed as kilocalorie expended per kilogram of body weight per hour of activity, kcal/kg/h, divided by 365 to convert yearly data into daily data.

Prevalence Rate

The rate of a disease in a given population. The numerator is the number of people in the population with the disease at a given point of time and the denominator is the total population at risk at that given point in time.

Renal Disease

ICD-9 codes # 580-587, 593

Sampling Variability

The variability in the estimate of a population characteristic due to sampling error.

Self-Reported Health

Response to the question on the NPHS: In general, how would you say your health is? Responses in the categories "Excellent", "Very Good" and "Good" were grouped into a category called "Good or better".

Skin Disease

ICD-9 codes # 681-682, 707, 785.4

Standard Population

A population structure that is used to provide a constant age distribution, so that the rates of different study populations can be adjusted to it and can be properly compared (see Age-Standardized Rates).

APPENDIX B
List of Data Sources

Hospital Morbidity Database (HMDB) – Canadian Institute for Health Information

The Canadian Institute for Health Information maintains the HMDB, which covers hospital separations – transfers, discharges, or deaths – in Canada. The hospital completes a record for each individual. In addition to demographic and administrative information, the database contains up to 16 diagnostic codes and some procedure codes.

The HMDB contains separation records from general and allied special hospitals, including acute care, convalescence, and chronic facilities (except in Ontario). The tables presented exclude information on newborns, out-of-province admissions, and a small number of records flagged as having serious errors. Records are not available for the Ontario Chronic Care Patient System, which accounted for about 1% of admissions in fiscal year 1996/97.

Mortality Database – Statistics Canada

Provincial and territorial offices of vital statistics submit information annually on all deaths from all vital statistics registries in Canada. An informant, usually a relative of the deceased, completes the personal information portion of the death registration form. The portion of the form comprising the medical certificate of death is completed by the medical practitioner last in attendance or by a coroner if an inquest or enquiry was held. The database includes demographic information and the underlying cause of death as defined by the physician.

National Diabetes Surveillance System (NDSS)

The NDSS uses provincial/territorial administrative databases to identify groups of individuals who are likely to have diabetes. The medical diagnosis recorded on both the physician service claims data and hospitalization data are utilized in the determination of diabetes

status. The initial data available from the system has been able to show the prevalence (number of existing cases) of diabetes and as the system matures, it is expected to be able to be useful in assessing the incidence (number of new cases). In addition, the system has the potential to be able to compare groups of individuals who have diabetes to the general population in order to assess how health care services are being used.

National Longitudinal Survey of Children and Youth (NLSCY) – Human Resource Development Canada (HRDC)

The primary objective of the NLSCY is to develop a national database on the characteristics and life experiences of Canadian children as they grow from infancy to adulthood. The survey collects cross-sectional information as well as longitudinal data. Data collection began in 1994/1995 and will be repeated every 2 years to follow the children surveyed in 1994/1995. In subsequent years, a cross-sectional sample will be added for age groups no longer covered by the longitudinal sample.

The NLSCY target population includes children in all provinces and territories, except children living in institutions, on Indian reserves, on Canadian Armed Forces Bases, and in some remote areas. The survey collects information on the child from the household member most knowledgeable about the child. Up to four children per household are chosen randomly. The survey is designed primarily for analysis at the national, regional, and in some cases provincial/territorial level. Analysis of sub-populations is limited by insufficient sample sizes.

National Population Health Survey (NPHS) – Statistics Canada

The NPHS collects information related to the health of the Canadian population and related socio-demographic information. The NPHS is composed of three components: the Household Survey, the Health Care Institution Survey and the Northern Territories Survey. The NPHS Household Survey has two sections – a longitudinal panel of individuals who are surveyed every 2 years (14,900 in 1996 and 14,200 in 1998) and a cross-sectional component (17,600 in 1994/95, 81,800 in 1996/97 and 17,200 in 1998/99). The data in this report come from the 1994/95, 1996/97, and 1998/99 cross-sectional household component of the NPHS – the Master File.

The NPHS household component includes household residents in all provinces/territories, with the exclusion of populations in Indian Reserves, Canadian Armed Forces Bases, and some remote areas in Quebec and Ontario. The first cycle of data collection began in 1994, and data will be collected every second year for approximately 20 years in total. Three cycles of collection are now completed for each component: NPHS

Cycle 1 (1994/1995), NPHS Cycle 2 (1996/1997), and NPHS Cycle 3 (1998/1999).

Aboriginal Peoples Survey (APS) – Statistics Canada

The objective of the 1991 APS was to provide a unique source of comprehensive data on the employment, education, language, mobility, health, lifestyle, and housing characteristics of Canada's Aboriginal peoples. The APS population defined through the 1991 Census includes those people who reported at least one Aboriginal origin (i.e. North American Indian, Métis, Inuit, or other Aboriginal groups such as Cree or Inuvialuit) for question 15 of the Census long questionnaire. It includes individuals who had indicated either a single Aboriginal origin; multiple ethnic origins, that is Aboriginal in combination with at least one other non-Aboriginal origin (e.g. English, Irish, etc); or multiple Aboriginal origins.

For each of the areas chosen for the survey, a list was compiled of people who had indicated Aboriginal origins and those who reported being registered under the Indian Act on their 1991 Census long questionnaire. A sample was selected from the list that allowed estimates to be made of the characteristics of Aboriginal people living on Indian reserves and settlements, in other Aboriginal communities, and in other areas in Canada.

IMS Health Dataset – Canadian Retail Pharmacies

CompuScript measures the number of prescriptions dispensed by Canadian retail pharmacies. Product information is presented according to therapeutic class and each individual product. The data collected can be used to ascertain product prescription volume and share, for trending purposes, thereby providing a measure of product utilization. By monitoring filled prescriptions as they pass into the hands of consumers, CompuScript can be used to evaluate education and information programs directed toward physicians, pharmacists, and consumers.

The CompuScript sample is drawn from the IMS prescription database panel, which now comprises over 4,400 pharmacies or nearly two-thirds of all retail pharmacies in Canada. Over 2,100 stores are used in the CompuScript panel, each stratified by province, type (chain or independent), and size (large or small). Records are collected monthly from each of these pharmacies, by diskette from stores with independent computer systems or by an external software supplier for stores that are part of a data network system. Sample data collected from this panel are projected to the universe in each province, and provincial totals are added together to provide a national estimate.

Notes