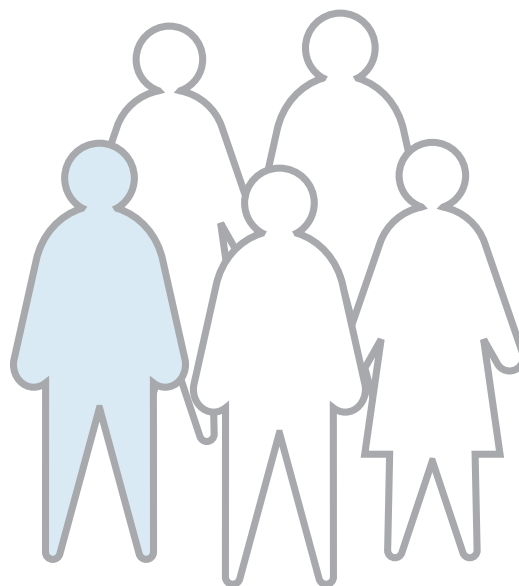


Chapter I

Background and Methods



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BACKGROUND AND METHODS

The Alberta Diabetes Surveillance System (ADSS) was created in 2006 in a partnership between Alberta Health and Wellness (AHW) and the Institute of Health Economics (IHE). The purpose of the ADSS is to provide information about diabetes within the province of Alberta. This information includes the incidence, prevalence and use of health care services for people with diabetes, along with information about their related comorbidities and complications.

Ongoing surveillance of diabetes through the ADSS will, over time, help to inform health professionals, regional health zones and AHW as to whether efforts to reduce the overall burden of diabetes are effective.

The first comprehensive report from the ADSS was the *Alberta Diabetes Atlas 2007*. It contained a broad perspective of the impact that diabetes has on Albertans and on the health care system. To enhance interpretability and usability, trends in diabetes and related conditions were presented over time (1995-2005), across ages and by geographic region. In 2007, nine Alberta health regions existed; however, in 2009, these health regions were combined to form five zones under one provincial health authority, Alberta Health Services (AHS). Geographically, the North zone encompasses the area of Peace Country, Northern Lights and Aspen health regions; Central zone encompasses David Thompson and East Central health regions; and South zone encompasses Chinook and Palliser health regions. The areas for the Calgary and Capital Health regions stayed the same except for renaming them the Calgary and Edmonton zones, respectively. The new zones are reflected on the provincial map (Figure 1.1) with white lines, and with the nine previous health regions in the background with dark lines. The information in the *Alberta Diabetes Atlas 2009* is summarized at the provincial and zone level.

The *Alberta Diabetes Atlas 2009* is a standalone report, and trend data should not be directly compared with the 2007 edition of the *Alberta Diabetes Atlas*. The numbers and figures will be similar, but direct comparisons cannot be made due to methodological differences in case definitions and revisions to AHW's historical data.

The content in the *Alberta Diabetes Atlas 2009* is an enhancement of the information that was presented in the last edition. For example, epidemiologic trends are included for children and adolescents; health care utilization data is now presented for not only the over-20-year-old population, but also for the under-20-year-old population, as well as for the Status Aboriginal population; the "Diabetes and Stroke" chapter has been expanded to include different types of stroke, such as hemorrhagic and ischemic; and the "Diabetes and Lower Limb Amputations" chapter has also been expanded to include information about foot disease.

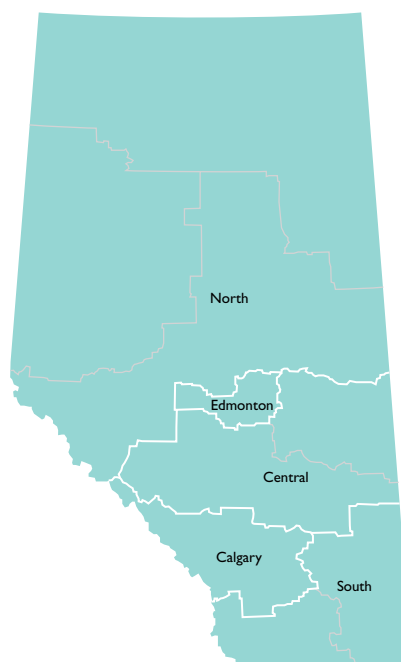
BACKGROUND

Diabetes is a chronic disease affecting more than 5% of Canadians over 20 years of age.⁽¹⁾ It is a serious and growing public health concern in Canada, where health care costs of patients with diabetes were projected to be in excess of \$6 billion in 2006.⁽²⁾ Surveillance of diabetes is therefore essential for quantifying the burden of disease and related complications, monitoring resource utilization, developing and evaluating policies and programs, and stimulating research.^(3,4)

To that end, the National Diabetes Surveillance System (NDSS) was launched in Canada in 1999 as part of the Canadian Diabetes Strategy. The NDSS currently utilizes existing provincial and territorial administrative health care data to identify diabetes cases.^(1,4-6) Prior to the development of the NDSS, estimates of the diabetes burden in Canada were based upon self-reported diabetes in surveys, hospital and mortality data, or extrapolated from figures within the U.S.⁽⁷⁾ Current goals of the NDSS include further development and maintenance of a national, comprehensive, standardized database for diabetes surveillance and provision of population-based diabetes information in order to evaluate health care utilization, policy and process.^(1,5) While very valuable, the information available from the NDSS is limited when considering local strategies and policy decisions. Provinces such as Alberta are able to produce substantially richer information in a timelier manner with the broad scope of administrative data.

In May 2003, AHW announced the Alberta Diabetes Strategy 2003-2013, which has a focus on the primary prevention of type 2 diabetes. Epidemiologic research has shown that key risk factors for type 2 diabetes (e.g. physical inactivity, obesity and dietary factors) may be changed by focusing on healthy living practices, particularly healthy eating and active living. Consequently, primary prevention is the focus and key to reducing the risk of developing type 2 diabetes. Additionally, the Alberta Diabetes Strategy also addresses the challenges faced by those who have already been diagnosed with diabetes. Helping those with diabetes to prevent and reduce serious complications is the focus of the secondary and tertiary prevention components of the Alberta Diabetes Strategy.

Figure I.1 Alberta Health Zones



DIABETES

Diabetes mellitus (DM) is a chronic health condition that is associated with increased morbidity and early mortality. Although there are different types of diabetes, administrative data such as those used for the NDSS and ADSS is presently unable to distinguish between them. It is still important, however, to recognize the different disease processes in order to assess the overall burden.

When someone has diabetes, it means that their body has difficulty making insulin and/or using the insulin that they produce. This is problematic because insulin is required to move glucose into cells so that it can be used by body tissues and organs. When glucose remains in the blood, blood glucose levels can rise to dangerously high levels and result in acute complications. Higher than normal blood glucose levels also can result in long-term organ damage and affect the eyes, kidneys and cardiovascular system.

Type 1 diabetes usually occurs early in life during childhood or adolescence. An organ called the pancreas is unable to produce insulin. This is why individuals with type 1 diabetes need to inject insulin several times a day. Type 1 diabetes accounts for 5% to 10% of all diabetes cases.

Type 2 diabetes is usually associated with onset after 30 to 40 years of age; however, during the past decade, type 2 diabetes has become much more prevalent in younger individuals. This is thought to be associated with lifestyle factors, including physical inactivity and obesity. In type 2 diabetes, the pancreas does not produce enough insulin, or the body does not properly use the insulin it makes. Type 2 diabetes accounts for 90% to 95% of all diabetes cases.

Gestational diabetes occurs only in pregnant women. It is a form of glucose intolerance which usually disappears after six weeks postpartum. There is evidence to suggest that women with gestational diabetes are at a higher risk of developing type 2 diabetes later in life.

Physical activity and a healthy diet are indicated for all individuals with diabetes. As stated above, regular insulin injections are required for people with type 1 diabetes, while those who have type 2 diabetes can sometimes be managed with exercise and diet alone. Depending on the severity of the disease, certain people who have type 2 diabetes may also need oral antidiabetic agents (e.g. pills) or even insulin to better control their blood glucose levels.

METHODS

The *Alberta Diabetes Atlas* is organized into ten main chapters, each focusing on an important aspect of diabetes in Alberta. Each chapter is organized in the same way. A short background is provided, though the focus of each chapter is on the trends over time and age-specific rates. Comments on these trends are provided and key points are highlighted.

Below is a general overview of the methods used in creating the *Alberta Diabetes Atlas*. Specific methods for each of the different topic areas are highlighted in the respective chapters.

Data Sources

This *Alberta Diabetes Atlas* contains data derived from a single source: the administrative databases of AHW. Publicly funded health insurance systems routinely generate person-specific administrative data every time a diagnosis is made or a procedure is billed to a provincial government. From a health surveillance perspective, the ADSS is able to capitalize on this information in order to report on the burden of diabetes in Alberta. These databases contain de-identified information at the personal level on demographics (e.g. age, sex and Aboriginal status); health care utilization (hospitalizations, physician services and ambulatory care); as well as diagnostic and procedural codes. Trends in diabetes and complications over a 13-year period, from 1995-2007, are reported unless otherwise specified.

The ADSS reports on diabetes and comorbidities and complications by employing data from the following AHW databases:

1. Discharge Abstract Database (hospital morbidity)
2. Alberta Physician Claims Data
3. Ambulatory Care Classification System (includes emergency department encounters)
4. Vital Statistics (including mortality)

Diabetes Case Definition

In order to identify a case of diabetes from the administrative databases, we applied the algorithm used by the NDSS. The current NDSS case definition requires that an individual must have **either**:

- *One hospitalization* with an ICD-9 code of 250 (diabetes mellitus), selected from all available diagnostic codes on the Hospital Discharge Abstract for years 1995-2001, or equivalent ICD-10 codes (E10-14) diabetes for years after 2001-2002;

or

- *Two physician claims* with an ICD-9 code of 250 (diabetes mellitus) *within 2 years*.

The case date is defined as the latest date of hospitalization, or the later of the two physician claims that contribute to the case definition.^(1,5) In validation studies, this case definition has been found to have a sensitivity ranging from 69% to 91% when compared with diabetes registries, medical charts, health survey data or drug claim data.^(6,8,9)

At the time that the the last version of the *Alberta Diabetes Atlas* was produced, the NDSS case definition had only been validated in individuals aged 20 years and older. As such, we only reported on the adult population. However, the diabetes case definition has since been validated in those under 20 years of age as well, and can now be applied across all ages.⁽¹⁰⁾ Therefore, in this version of the *Atlas*, we also present diabetes trends for the entire population (for those who are 1 year or older). While we demonstrate that diabetes in children is also increasing, the majority of people with diabetes are still adults. One difference to note between the ADSS and the NDSS case definitions is that we chose not to exclude women who may have had gestational diabetes, as indicated by codes for pregnancy or obstetric procedures. We included these cases due to the elevated risk of subsequently developing diabetes, thus allowing the ADSS to assess that risk on a population basis in the future.

Incidence, Prevalence and Mortality Rates

In order to interpret the results of this *Atlas*, it is important to understand the terms *incidence* and *prevalence*.

Incidence is a measure of new diabetes cases arising within a particular timeframe. Therefore, diabetes incidence is the number or the rate of new cases each year in Alberta. To calculate diabetes incidence, the following formula is used:

$$\frac{\text{Total \# of people with a diabetes incident date in the current calendar year}}{(\text{Total population count for current calendar year}) - (\text{Prevalent diabetes cases}) + (\text{Incident diabetes cases})}$$

It is important to subtract the prevalent or existing diabetes cases from the denominator because those who already have diabetes are not at risk of developing it.

Prevalence is the number or rate of diabetes cases existing within a population during a particular time period. Prevalence includes incidence, or in other words, existing cases include new cases. For example, if an individual becomes incident one year, they are also considered prevalent in that year and every subsequent year. The following formula is used to calculate diabetes prevalence:

$$\frac{\text{Total \# of people with diabetes in the current calendar year}}{\text{Total population count for current calendar year}}$$

Estimates of incidence, prevalence and total population counts in Alberta are taken from the mid-year AHW data. The calculated rates are also reported as age- and sex-adjusted to the Alberta population from the 2001 Canadian Census in order to account for differences in population age structure over time.⁽¹¹⁾

The *Alberta Diabetes Atlas* also reports on mortality in Alberta. The mortality rates among people with and without diabetes are compared in chapter 2, “Epidemiological Trends of Diabetes in Alberta,” and in chapter 10, “Diabetes and the Status Aboriginal Population in Alberta.” The ratio between the two rates reflects the significance of diabetes mortality in the population in question. The following formula is used to calculate mortality rate:

$$\text{Mortality (with diabetes)} = \frac{\text{Total \# of deaths among people with diabetes during the current calendar year}}{\text{Total \# of people with diabetes during the current calendar year}}$$

$$\text{Mortality (without diabetes)} = \frac{\text{Total \# of deaths among people without diabetes during the current calendar year}}{\text{Total \# of people without diabetes during the current calendar year}}$$

$$\text{Mortality rate ratio} = \frac{\text{Mortality rate among persons with diabetes}}{\text{Mortality rate among persons without diabetes}}$$

Health Care Utilization

It is intuitive that individuals who are sicker consume more health care resources. This is the case in people with diabetes due to the amount of complications and comorbidities they suffer.^(12,13) Use of physician services in the community, and admissions to the emergency department and hospital, are reported for people with and without diabetes in this *Atlas*.

Diabetes Complications and Comorbidities

Higher or lower than normal blood glucose levels are associated with acute complications of diabetes that can be life-threatening. Mild lows can be treated by taking some sugar or juice. More severe blood sugar lows or highs may require medication or use of emergency services.

In addition to these acute complications, chronic complications tend to occur over time and are responsible for the majority of the morbidity and mortality for people with diabetes. Chronic complications that can occur include blindness and other forms of eye disease, cardiovascular disease, kidney problems and nerve damage. Furthermore, the impact of chronic medical conditions, such as diabetes on mental health, is becoming increasingly recognized.

The *Alberta Diabetes Atlas 2009* contains chapters on these important complications and comorbidities associated with diabetes. For each specific topic, rates will be compared in people with diabetes and people without diabetes. As with the case definition for diabetes itself, case definitions for the specific complications and comorbidities are based on diagnostic or procedural codes contained in the administrative databases. The specific case definitions for these are identified and listed in the appendix of each relevant chapter.

Diabetes and the Status Aboriginal Population

The epidemiology of diabetes in the Status Aboriginal population is considerably different from the general population in Canada.⁽¹⁴⁾ In addition, mortality rates are higher and diabetes complications are more common among Status Aboriginals. The ongoing surveillance of diabetes in the Status Aboriginal population is an important part of the ADSS. In this version of the *Alberta Diabetes Atlas*, we report on the incidence, prevalence and age-specific trends in the Status Aboriginal population compared to the general population of Alberta with and without diabetes. We also report on the under-20-year-old Status Aboriginal population, as well as on health care utilization.

SUMMARY

Clearly, diabetes is a significant and contemporary health concern that will continue to have an increasing impact on provincial and federal health care systems and on the health of all Canadians. The ADSS is a key component of the Alberta Diabetes Strategy, which is aimed at reducing the burden of diabetes for Albertans. This *Alberta Diabetes Atlas* provides a broad perspective of the burden that diabetes has on Alberta.

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