

## 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 on diabetes in 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 authorities and Alberta Health and Wellness if efforts to reduce the overall burden of diabetes are effective.

You are reading the first version of the **Alberta Diabetes Atlas**. It is the first comprehensive document produced in Alberta that contains a broad perspective of the impact that diabetes has on Albertans and on the health care system. To enhance interpretability and usability, this information is summarized at the provincial and health regional level (see Figure 1.1). This **Alberta Diabetes Atlas** has been distributed to all regional health authorities and diabetes health professionals in the province.

### BACKGROUND

Diabetes is a chronic disease affecting more than 5% of Canadians over 20 years of age.<sup>(1)</sup> It is a serious and growing public health concern in Canada, where healthcare costs of patients with diabetes are projected to be in excess of \$6 billion in 2006.<sup>(2)</sup> 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.<sup>(3,4)</sup>

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.<sup>(1,4-6)</sup> 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 American figures.<sup>(7)</sup> 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.<sup>(1,5)</sup> 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 more timely manner with the broad scope of administrative data.

Figure I.1 **Alberta Health Regions**



In May 2003, Alberta Health and Wellness announced the Alberta Diabetes Strategy 2003-2013 with 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, Alberta's 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.

## 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 data 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 5-10% of all diabetes cases.

Type 2 diabetes is usually associated with onset after 30-40 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 90-95% 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 8 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, but the focus of each chapter is on the trends over time, the age-specific rates, and the regional picture of diabetes in Alberta, presented in graphical or map formats. Comments on these trends are provided and key points are highlighted.

Below is a general overview of the methods used in creating this **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 Alberta Health and Wellness. Publicly funded health insurance systems routinely generate person-specific administrative data every time a diagnosis is made or a procedure is billed to the provincial governments. From a health surveillance perspective, the ADSS is able to capitalize on this in order to report on the true burden of diabetes in Alberta. These databases contain de-identified information at the personal level on demographics (age, sex, health region, First Nations status), health care utilization (hospitalizations, physician services, ambulatory care), as well as diagnostic and procedure codes. Trends in diabetes and complications over a ten year period, from 1995 to 2005 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 - 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 two 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.<sup>(1,5)</sup> 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.<sup>(6,8,9)</sup>

The current NDSS case definition has been validated in individuals aged 20 years and over. As such, we are only reporting on the adult population in this version of the **Alberta Diabetes Atlas**. While diabetes in children is increasing, the majority of people with diabetes are still adults. Nonetheless the NDSS is currently developing a strategy to include the population under 20 years of age in the ongoing surveillance of diabetes. Future versions of the **Alberta Diabetes Atlas** will report on the full population.

One difference to note between the ADSS and the NDSS case definitions is that we chose not to exclude women who may have 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 Alberta Health and Wellness 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, or in different health regions.<sup>(10)</sup>

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. 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.<sup>(11,12)</sup> 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 are 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** 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 procedure 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 First Nations

The epidemiology of diabetes in the First Nations population is considerably different from the non-First Nations population in Canada.<sup>(13)</sup> In addition, mortality rates and diabetes complications are more common among First Nations people than non-First Nations people. The ongoing surveillance of diabetes in First Nations people is an important part of the ADSS. In this version of the **Alberta Diabetes Atlas**, we report on the incidence, prevalence, age-specific and regional trends of First Nations and non-First Nations for those with and without diabetes.

## 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 Alberta Diabetes Surveillance System 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.

## References

1. Health Canada. 2nd Report on the National Diabetes Surveillance System. 2007. Ottawa, Health Canada.
2. Ohinmaa A, Jacobs P, Simpson SH, Johnson JA: The projection of prevalence and cost of diabetes in Canada: 2000 to 2016. *Canadian Journal of Diabetes* 28:116-23, 2004
3. Safran MA, Vinicor F: The war against diabetes. How will we know if we are winning? *Diabetes Care* 22:508-516, 1999
4. Saydah SH, Geiss LS, Tierney E, Benjamin SM, Engelgau M, Brancati F: Review of the performance of methods to identify diabetes cases among vital statistics, administrative, and survey data. *Ann Epidemiol* 14:507-516, 2004
5. Health Canada. Responding to the challenge of diabetes in Canada. First report of the National Diabetes Surveillance System (NDSS). 2003. Ottawa, Health Canada.
6. Hux JE, Ivis F, Flintoft V, Bica A: Diabetes in Ontario: determination of prevalence and incidence using a validated administrative data algorithm. *Diabetes Care* 25:512-516, 2002
7. Clotey C, Mo F, LeBrun B, Mickelson P, Niles J, Robbins G: The development of the National Diabetes Surveillance System (NDSS) in Canada. *Chronic Dis Can* 22:67-69, 2001
8. LeBlanc, J. and Kephart, G. Assessment of the sensitivity and specificity of Nova Scotia administrative databases for detecting diabetes mellitus. Report to NDSS Validation Working Group. 1998. Halifax, Population Health Research Unit.
9. Van Til, L. Report to NDSS Validation Working Group. 2001. Charlottetown, Document Publishing Center.
10. Statistics Canada: Age and Sex for Population, for Canada, Provinces, Territories, Census Metropolitan Areas and Census Agglomerations, 2001 Census. [article online], 2007. Accessed Catalog Number: 95F0300XCB2001004
11. Hux JE, Booth GL, Slaughter PM, Laupacis A (eds). Diabetes in Ontario: An ICES Practice Atlas: Institute for Clinical Evaluative Sciences, 2003.
12. Simpson SH, Corabian P, Jacobs P, Johnson JA: The cost of major comorbidity in people with diabetes mellitus. *CMAJ* 168:1661-1667, 2003
13. First Nations Information Governance Committee by the First Nations Centre at the National Aboriginal Health Organization. First Nations and Inuit Regional Health Surveys, 1997; A Synthesis of the National and Regional Reports. 2004. 10-11-2006.