Chapter 3

Diabetes in Children and Adolescents

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DIABETES IN CHILDREN AND ADOLESCENTS

KEY MESSAGES

- Diabetes is a growing health issue for children and adolescents in Alberta.
- In 2007, there were nearly 2,600 children and adolescents living with diabetes in Alberta.
- Over 400 new cases of diabetes were identified in the under-20-year-old population in 2007.

BACKGROUND

In the *Alberta Diabetes Atlas* 2007, we did not incorporate a description of diabetes epidemiology for children and adolescents, as this age group was not included in the scope of our surveillance at that time. Recently, the National Diabetes Surveillance System (NDSS) has adopted their adult diabetes case definition for the under-20-year-old population. Similarly, for this edition of the *Atlas*, we have applied this definition to the under-20-year-old population to expand our surveillance methods. In this chapter, we will look at prevalence and incidence trends of diabetes among the under-20-year-old population in Alberta between 1995-2007.

While the majority of diabetes cases occur among adults, the prevalence and incidence of diabetes among children and adolescents are on the rise. In the adult population, type 1 diabetes accounts for approximately 5% to 10% of all cases.(1) In children and adolescents, however, type 1 has traditionally been the main form of the disease.(2) Furthermore, in children under the age of 10, type 1 diabetes is almost always observed.(2) As a result, the majority of the research and literature addressing diabetes in children and adolescents has focused on type 1. That said, increasing diagnoses of type 2 diabetes have also been reported in the younger population.(3) This trend parallels the increasing prevalence of childhood overweight and obesity worldwide.(4)

While national estimates of diabetes incidence for children and adolescents are not currently available, past estimates for Alberta have ranged from 20.6 to 23.3 per 100,000/year.(5) These estimates put our population near the higher end of the global scale, below countries such as Finland and the United Kingdom.(5)

METHODS

Children and adolescents with diabetes were identified within Alberta Health and Wellness (AHW) administrative databases by applying the NDSS algorithm (see "Background and Methods" chapter). Unfortunately, this definition does not allow us to distinguish between type 1 or type 2 diabetes.

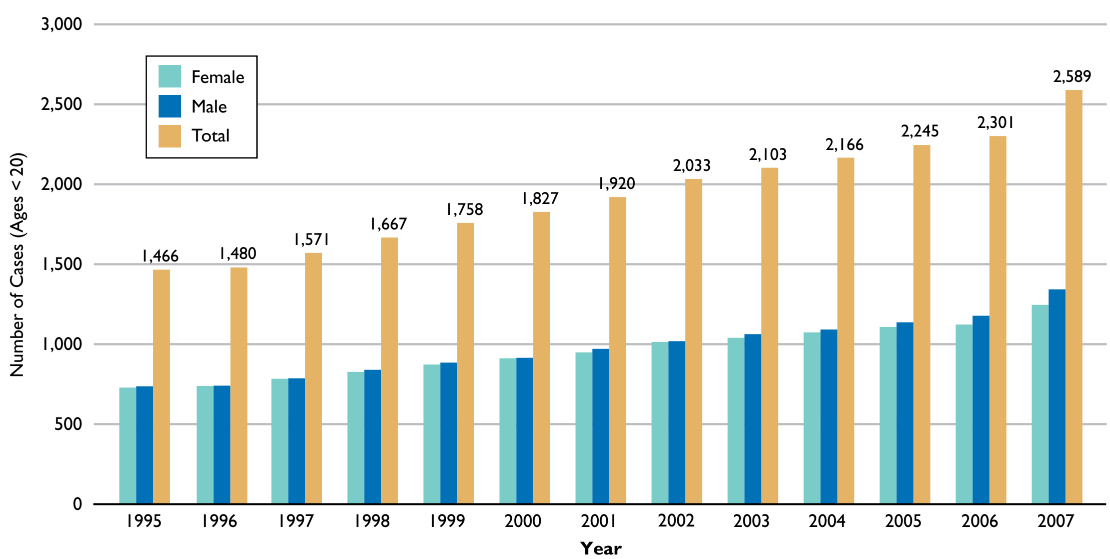
We have identified cases as children or adolescents if they were aged less than 20 years old on the date of their diabetes-related hospital discharge or on the date of their second diabetes physician billing claim. Therefore, throughout the *Atlas*, the terms "children and adolescents" and "under-20-year-old population" will be used interchangeably.

In order to calculate the age-specific rates, the number of cases in each age group was divided by the estimated number of children and adolescents in the province in that age group registered with AHW as of June 30 each year. For these analyses, we have separated the under-20-year-old cases into 4-year age groups, consistent with groupings used by pediatric endocrinologists in the province: ages 1-4, 5-9, 10-14 and 15-19 years.

PREVALENCE

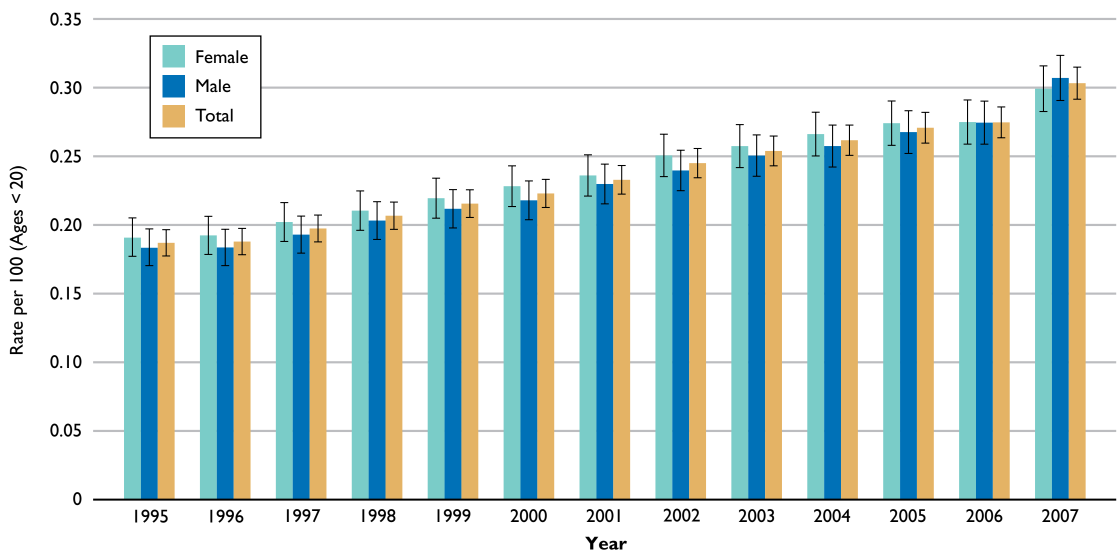
In 2007, approximately 2,600 children and adolescents were living with diabetes in Alberta. This represents more than 1,000 cases than 12 years earlier (Figure 3.1). Over this time period, the number of males with diabetes compared to females was very similar. In recent years, the proportion of prevalent cases that are males has increased slightly relative to females.

Figure 3.1 **Prevalent Diabetes Cases, 1995-2007**



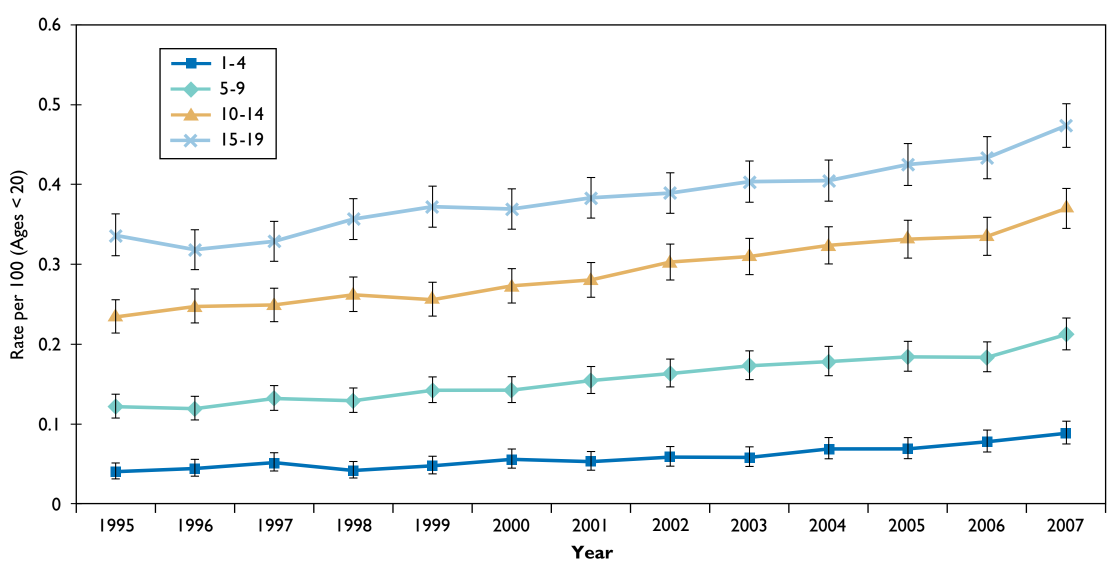
Between 1995-2007, the prevalence of diabetes in children and adolescents increased by over 62%, from 0.19 to 0.30 per 100 (Figure 3.2). This increase was observed for both sexes, but was larger in males than in females (67% and 57% respectively).

Figure 3.2 **Crude Diabetes Prevalence Rates, 1995-2007**



The age-specific trends for diabetes in the under-20-year-old population show a steady increase in the prevalence of diabetes for all age groups (Figure 3.3). The largest increase in prevalence was observed in the youngest age group (1-4 year olds), where the estimated rate more than doubled (0.04 to 0.09 per 100). The prevalence rates increased by approximately 74%, 58% and 41% in the 5-9, 10-14 and 15-19-year-old age groups, respectively. Overall, the prevalence rates increased with age, with the highest rates observed in the 15-19 age group.

Figure 3.3 **Age-Specific Diabetes Prevalence Rates, 1995-2007**



The prevalence of diabetes in the under-20-year-old population is highest in the Central zone (Figures 3.4 and 3.5). The males had a higher prevalence rate in the North and Central zones, with the rest of the province balanced between males and females. Because the numbers of new cases of diabetes in the children and adolescents is relatively small, we are unable to present separate estimates of diabetes incidence by the health zones.

Figure 3.4 **Crude Diabetes Prevalence Rates for Children and Adolescents by Zone, 2007**

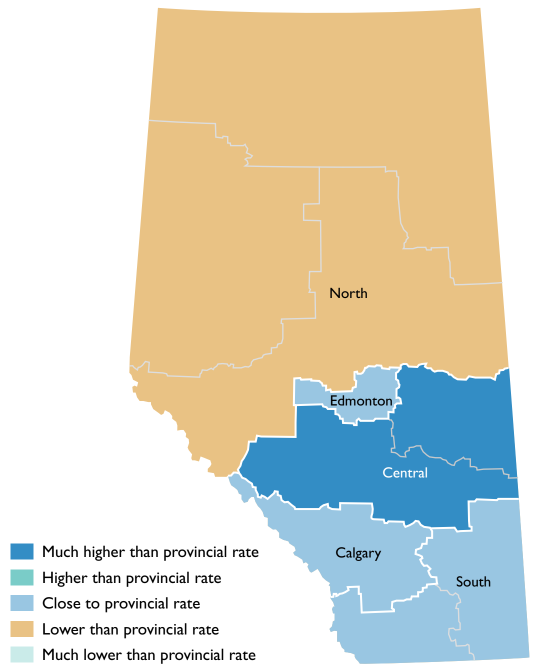
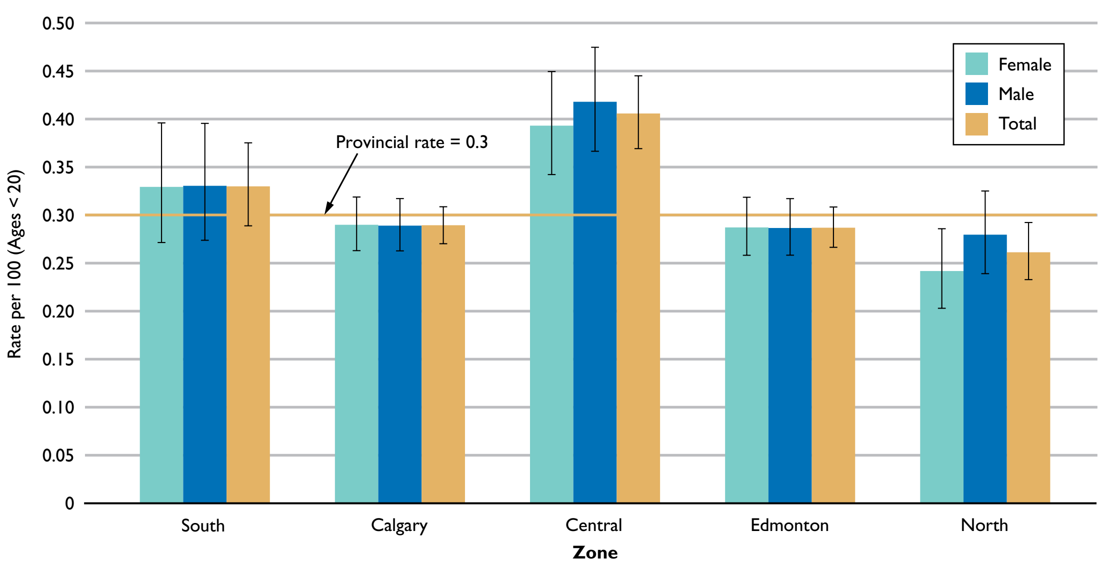


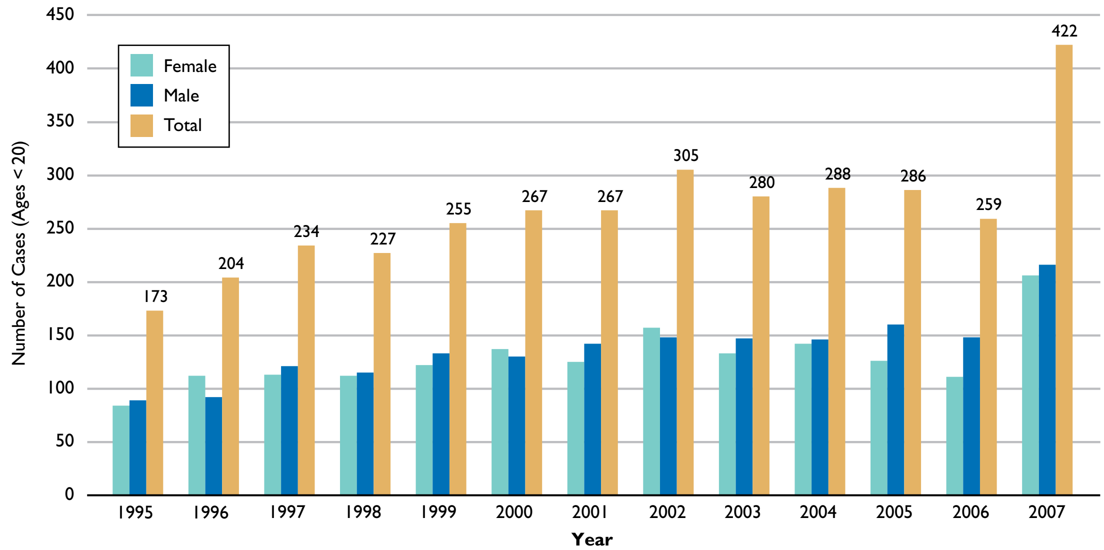
Figure 3.5 **Crude Diabetes Prevalence Rates by Zone, 2007**



INCIDENCE

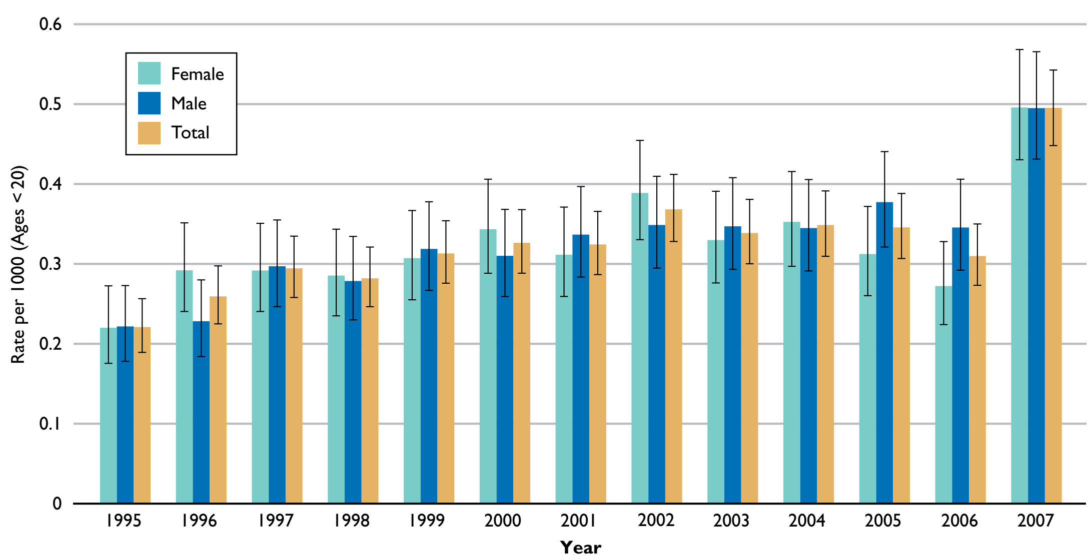
The number of incident diabetes cases in the under-20-year-old population increased by almost 144% between 1995-2007 in Alberta (Figure 3.6). This increase was modest up until 2006, but 2007 saw a much higher case count of 422 newly identified children and adolescents with diabetes.

Figure 3.6 **Incident Diabetes Cases, 1995-2007**



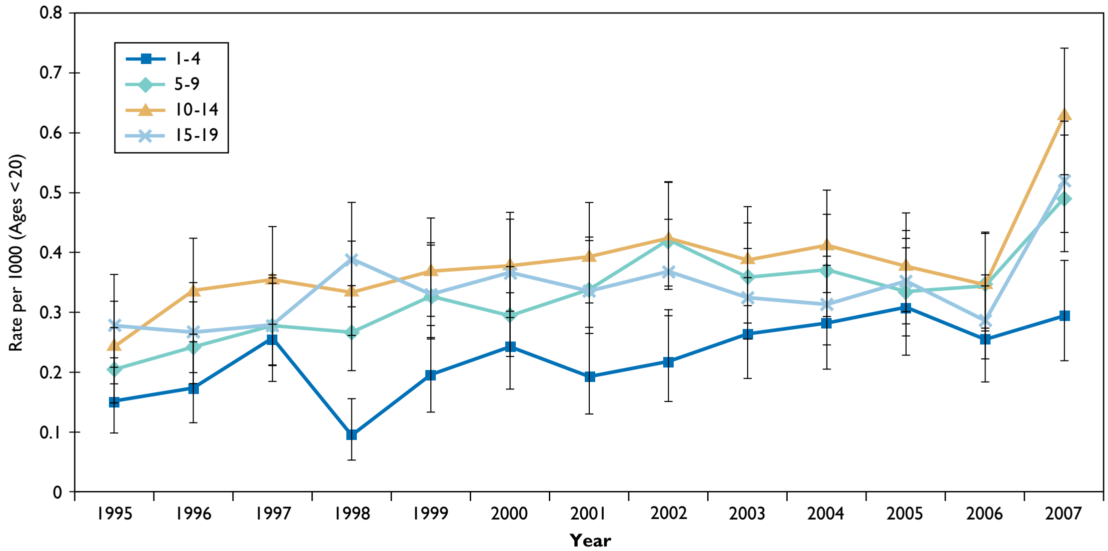
Diabetes incidence rates increased rapidly between 1995-2002, from an estimated 0.22 to almost 0.37 cases per 1000 (Figure 3.7). This represented a 67% increase. After 2002, rates leveled off and declined through 2006, to 0.31 cases per 1000. Then, interestingly, in the year 2007, we observed a sharp increase in the incidence rate that appeared consistent with the trend observed before 2002.

Figure 3.7 **Crude Diabetes Incidence Rates, 1995-2007**



Looking more closely at the age-specific diabetes incidence rates (Figure 3.8), we observed that the trends seen in the crude incidence rates (Figure 3.7) appear most prominent in older children and adolescents (an increase in incidence until the year 2002, followed by declining rates with a spike in 2007). Between 1995-2007, the lowest overall increase in incidence rates was observed in the 15-19 age group, and the highest was observed in the 10-14 age group.

Figure 3.8 **Age-Specific Diabetes Incidence Rates, 1995-2007**



DISCUSSION

In Canada, our publically funded model of health care provides a valuable resource of administrative health information for population-level disease surveillance. The sources that we draw from for the *Alberta Diabetes Atlas* are provincial hospitalization discharge codes from discharge abstract summaries and physician billing claims. A limitation of the analyses in this chapter is that these data were not collected for the purposes of research and may be vulnerable to error.

One example may be the observed incidence trends for the under-20-year-old population in Alberta. From 1995-2002, we noted a rise in the number of children and adolescents with diabetes. However, the recent dip and plateau in incidence rates are not in agreement with historical and international trends. One possible explanation for these observations may be specific policy changes in Alberta which may have affected the quality of the administrative data on which the Alberta Diabetes Surveillance System (ADSS) is based; in particular, the introduction of Alternative Relationship Plans in 2003 and the updated ICD-10-CA diagnostic coding in 2001-2002.

In Canada, our publicly-funded health care system provides a rich source of health information to researchers. This system has typically reimbursed physicians on a fee-for-service (FFS) basis. Under this model, physicians must submit billing claims for each patient seen in order to receive payment. These service claims contribute to our knowledge of disease prevalence and distribution in Canada by comprehensively accounting for each health encounter an individual has with their health provider. This FFS data has been the basis for the development of the NDSS, and for its current expansion to surveillance of other chronic conditions. Recently, however, several jurisdictions across the country have implemented alternative approaches to payment known as Alternative Payment Plans (APPs) or in Alberta, Alternate Relationship Plans (ARPs). These ARPs were signed between the provincial government and pediatric endocrinologists in Alberta in 2003. The introduction of APPs across Canada has changed the way that many physicians are reimbursed. While they are contractually required to continue submitting billing claims, a practice known as shadow billing, physicians are often not paid for the time spent doing this and the importance of this continued practice is not often emphasized. In 2005-2006, 10% of physicians in Alberta were receiving some form of alternate payments.[6] If shadow-billing is not occurring at physician-patient encounters at the same rate as the FFS model, then it may lower our case capture under the NDSS and ADSS definition.

A second possible source of error may be associated with the transition to the latest revision of the International Classification of Diseases, Canadian Enhancement (ICD-10-CA), implemented in Alberta in 2001-2002. Currently, ICD-10-CA is used for coding discharge or death from hospitals, with ICD-9 coding still used by outpatient physicians.[7] While ICD-10-CA may remain comparable to ICD-9, it is unclear whether the new coding structure will affect disease surveillance.

To address these potential limitations in our surveillance system, we are now exploring the administrative records in more detail. We aim to determine the extent to which ARPs or changes in billings played a role in differences in incidence rates over time. This will include analyses of the age-specific incidence rates for children and adolescents living in different areas of the province, as well as the source of the case identification claim (i.e. physician claim or hospital discharge). If the observed incidence rate trends are explained by changes to policies such as these, we can help inform both surveillance systems and future policy changes.

CONCLUSION

It is unfortunate that children and adolescents appear to be following the increasing rates of diabetes seen in adults. Data validity will be essential to our continued understanding of these trends. To achieve the highest possible accuracy in our estimates, we will continue to scrutinize and improve our data collection methods.

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