The Epidemiology of Diabetes in the Manitoba-Registered First Nation Population

Current patterns and comparative trends

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OBJECTIVE — This study provides an overview of the epidemiology of diabetes in the Manitoba First Nation population.

RESEARCH DESIGN AND METHODS — The study uses data derived from the population-based Manitoba Diabetes Database to compare the demographic and geographic patterns of diabetes in the Manitoba First Nation population to the non–First Nation population.

RESULTS — Although the prevalence of diabetes rose steadily in both the First Nation and the non–First Nation populations between 1989 and 1998, the epidemiological pattern of diabetes in these two populations differed significantly. The First Nation population was observed to have age-standardized incidence and prevalence rates of diabetes up to 4.5 times higher than those found in the non–First Nation population. The sex ratio and the geographic patterning of diabetes incidence and prevalence in the two study populations were reversed.

CONCLUSIONS — The results of the study suggest that diabetes prevalence will likely continue to rise in the Manitoba First Nation population into the foreseeable future, and that the impact of this rising diabetes prevalence can only be effectively managed through a population-based public health approach focusing on primary and secondary prevention. The dramatically higher rates of diabetes in Manitoba First Nation population as compared with the non–First Nation population highlight the urgency of this activity. These prevention efforts need to be supported by further research into the reasons for the unique epidemiological patterns of diabetes incidence and prevalence in the First Nation population observed in this study. These include investigating why First Nation populations living in the Northern areas of the province seem to be protected from developing high rates of diabetes and why First Nation women experience much higher rates of the disease.

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Diabetes is increasingly responsible for substantial morbidity and mortality in Canada's First Nation populations. Planning and implementing effective primary and secondary intervention programs to deal with this disease and its devastating effects in First Nation people requires accurate population-based data on the temporal trends and geographic distribution of diabetes (1).

This study uses Manitoba Health administrative databases to examine trends in the incidence and prevalence of diabetes among Registered First Nation adults in Manitoba from 1989 to 1998. Comparisons are made to the non–First Nation adult population to highlight the magnitude of the diabetes epidemic in First Nation people. The geographic variation in diabetes rates across Manitoba is also examined.

The study was conducted in the Canadian province of Manitoba. Manitoba has a population of 1.14 million people, of whom more than one-half (645,000) reside in the City of Winnipeg, the provincial capital. The majority of Manitobans are of European descent, whereas ~10% of the population is self-identified as having Aboriginal ancestry (2). Manitoba has a universal health insurance plan, and all residents of the province are eligible to receive health care services with no payments required at the time of service.

RESEARCH DESIGN AND METHODS

Data sources

The data used for this study were derived from the Manitoba diabetes database (MDD), which has been described previously (3). This database contains a longitudinal record for Manitoba residents of all physician contacts and hospital separation records that cited a diagnosis of diabetes (ICD-9-CM code 250) between 1 April 1984 and 31 March 1999. Individuals are categorized as having diabetes if they have had at least two separate physician contacts for diabetes within 2 years of each other or at least one hospital separation for diabetes. Cases of gestational diabetes are excluded from the MDD. The sensitivity of this database for detecting clinically diagnosed cases of diabetes has been demonstrated, and the validity of the methodology has been discussed previously (3). This methodology is unable to distinguish between type 2 and type 1 di-

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Abbreviations: CCA, community characterization area; MDD, Manitoba diabetes database; RHA, regional health authority.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

abetes. Individuals who move from the province subsequent to being identified as having diabetes are included in the MDD only for the years that they are residents in the province.

Manitoba's First Nation population is comprised of individuals who are registered under the Indian Act of Canada and living in Manitoba. To identify people belonging to Manitoba's First Nation population, the Manitoba Health population registry was used. As part of the process for registration within Manitoba Health's insurance system, an attempt is made to verify whether new registrants are registered as Indian. If so, their First Nation affiliation is recorded. It is important to note that for a variety of complex historical and political reasons many individuals of Aboriginal ancestry are not eligible for registration under the Indian Act of Canada. These individuals are therefore not identified as First Nation in this study. Also, approximately only 70% of the registered First Nation population living in the province of Manitoba is identified as being First Nation in the Manitoba Health population registry.

Estimating incidence and prevalence

The diagnosis date of incident cases was defined based on the first physician contact for a diagnosis of diabetes, which was followed within 2 years by a subsequent physician contact or by the hospitalization for diabetes, whichever came first. The annual incidence rates were calculated using the mid-year population at risk based on the Manitoba population registry. The population at risk is the population at mid-year without diabetes. The average annual incidence rates for the years 1994–1998 were computed by cumulating all incident cases and summing the mid-year population at risk for those years. The point prevalence at December of each year was estimated by determining the number of cases that had previously been diagnosed who had neither died nor left the province at that time. This was done using the Manitoba Health population registry, which is routinely updated and closely matches census population estimates. The average annual prevalence rates for 1994–1998 were computed by cumulating the point prevalent cases for each of the 5-year periods and summing the mid-year populations for those years. Average annual incidence and prevalence rates for 1994–1998 were calculated to maximize rate stability when making geographic comparisons. To facilitate comparisons across time and with other published reports and studies, age-adjusted rates were computed for both incidence and prevalence by the direct method using the 1991 Canadian population as the standard.

To examine the geographic variations in cases of diabetes, the province was divided into 22 regions. The City of Winnipeg was divided into 12 community characterization areas (CCAs). CCAs are administrative areas used by the Winnipeg Regional Health Authority to deliver health services. CCAs were used in this study because >60% of the province's population resides within Winnipeg. Rural Manitoba was divided into 10 regional health authority (RHA) areas. The two northern RHAs of Burntwood and Churchill were combined for this study to maintain the population size required to ensure stable rate calculations. The average population size of each region was ~50,000. Age-adjusted incidence and prevalence rates for each region were calculated using the 1991 Canadian population as a standard.

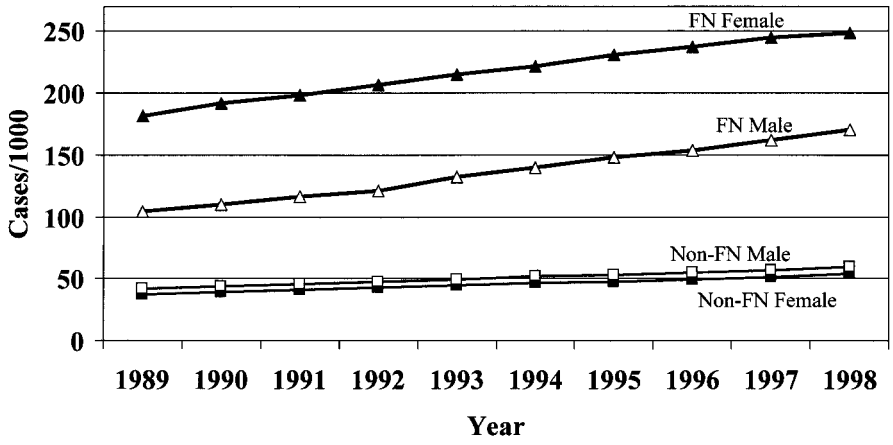

Figure 1—*Point prevalence of diabetes in the Manitoba population. Aged ≥20 years; standardized to the 1991 Canadian population. FN, First Nation.*

RESULTS

Time trends

The age-adjusted prevalence of diabetes among individuals aged ≥20 years increased steadily between 1989 and 1998 for First Nation and non–First Nation men and women (Fig. 1). Among First Nation women, the age-adjusted prevalence increased by 37% from 181.6/1,000 in 1989 to 248.7/1,000 in 1998. Among First Nation men, there was a 1.6-fold increase from 104.2/1,000 in 1989 to 170/1,000 in 1998. There were also increases in prevalence among non–First Nation men (1.4-fold, from 41.9 to 59.63/1,000) and women (1.4-fold, from 37.1 to 53.5/1,000). Throughout the study period, First Nation men had an average diabetes prevalence rate 2.5 times higher than non–First Nation men, whereas First Nation women had an average diabetes prevalence rate 4.5 times higher than non–First Nation women.

The age-adjusted incidence of diabetes among individuals aged ≥20 years increased slightly for First Nation men and Non–First Nation men and women between 1989 and 1998. The incidence in First Nation women did not change during this period. Among First Nation men, there was 1.4-fold increase from 15.3/1,000 in 1989 to 21.1/1,000 in 1998. There were also increases in incidence among non–First Nation men (1.25-fold, from 5.44/1,000 to 6.8/1,000) and women (1.2-fold, from 4.7/1,000 to 5.7/1,000). Throughout the study period, First Nation men had an average diabetes incidence rate three times higher than non–First Nation men, whereas First Nation women had an average diabetes incidence rate 3.7 times higher than non–First Nation women.

Age- and sex-specific incidence and prevalence

Age-specific incidence and prevalence of diabetes were substantially higher among the First Nation population as compared

Table 1—*Age-specific and age-adjusted prevalence (per 1,000 adults) of diagnosed diabetes in Manitoba, 1998, First Nation population compared with non–First Nation population*

	First Nation population		Non–First Nation population		Comparison
	Cases	Prevalence per 1,000	Cases	Prevalence per 1,000	Prevalence ratio*
Sex and age-group (years)					
Women					
20–24	78	26.79	261	7.47	3.58
25–29	173	57.99	433	12.23	4.74
30–34	262	94.14	743	19.468	4.83
35–39	343	143.81	1,129	25.14	5.72
40–44	368	203.20	1,335	31.09	6.53
45–49	393	313.39	1,666	43.30	7.22
50–54	410	415.82	2,135	64.77	6.41
55–59	333	471.67	2,145	84.27	5.59
60–64	316	539.25	2,406	110.06	4.89
65–69	216	535.9	2,836	133.47	4.01
70+	359	509.21	10,249	150.95	3.37
Total (crude)	3,251	185.63	25,338	62.68	2.96
Age adjusted†	—	248.70	—	53.54	4.64
Men					
20–24	28	9.93	210	5.90	1.68
25–29	73	26.85	305	8.55	3.14
30–34	133	51.01	481	12.56	4.06
35–39	184	80.98	788	17.35	4.66
40–44	232	139.33	1,157	26.77	5.20
45–49	302	236.86	1,778	46.57	5.08
50–54	351	336.20	2,454	74.30	4.52
55–59	262	340.25	2,617	104.95	3.24
60–64	218	371.37	2,864	135.63	2.73
65–69	162	390.36	3,214	163.72	2.38
70+	217	317.25	8,307	184.73	1.71
Total (crude)	2,162	128.27	24,175	63.62	2.01
Age adjusted†	—	170.01	—	59.38	2.86
Total (crude)	5,413	157.50	49,513	63.13	2.34
Age adjusted†	—	209.70	—	56.06	3.74

*Ratio of First Nation prevalence to non–First Nation prevalence. †Adjusted to the 1991 Canadian population.

with non–First Nation people in all age-groups. Whereas the incidence and prevalence among non–First Nation individuals increased steadily with age, among the First Nation population both incidence and prevalence peaked in the 60- to 69-year-old age-group and began to fall in the group aged ≥70 years. The highest prevalence difference between First Nation and non–First Nation women occurred in the 45- to 49-year-old age-group, with a prevalence ratio of 7.2 (Table 1). In men, the highest prevalence difference occurred in the 40- to 44-year-old age-group (prevalence ratio of 5.2).

In the First Nation population, both incidence and prevalence of diabetes were higher among women than in men. The opposite trend was observed in the non–First Nation population.

Distribution by geographic region

Although the incidence and prevalence of diabetes was substantially higher among the First Nation than the non–First Nation population in all geographic areas, the geographic patterns differed (Fig. 2). In the First Nation population, the highest prevalence of diabetes was among those who lived in the southwestern rural area of the province (290/1,000) and in the eastern and western sections of the City of Winnipeg. The lowest prevalence was among those living primarily in the more remote northern rural areas of the province and in the southern section of the City of Winnipeg. In contrast, among non–First Nation populations, the highest rates were found in the more remote northern rural areas of the province and in the central downtown area of the City of Winnipeg. Similar patterns were observed for diabetes incidence.

Relationship among incidence, mortality, and increasing prevalence

Figure 3 illustrates that the annual incidence of diabetes exceeded annual mortality in the First Nation population with diabetes between 1989 and 1998, leading to net annual increases in diabetes cases over the entire study period.

CONCLUSIONS — The prevalence of diabetes in First Nation population observed in this study are comparable with those observed in other studies. Harris (4), using data collected through an intensive community-wide prevalence survey, reported age standardized prevalence

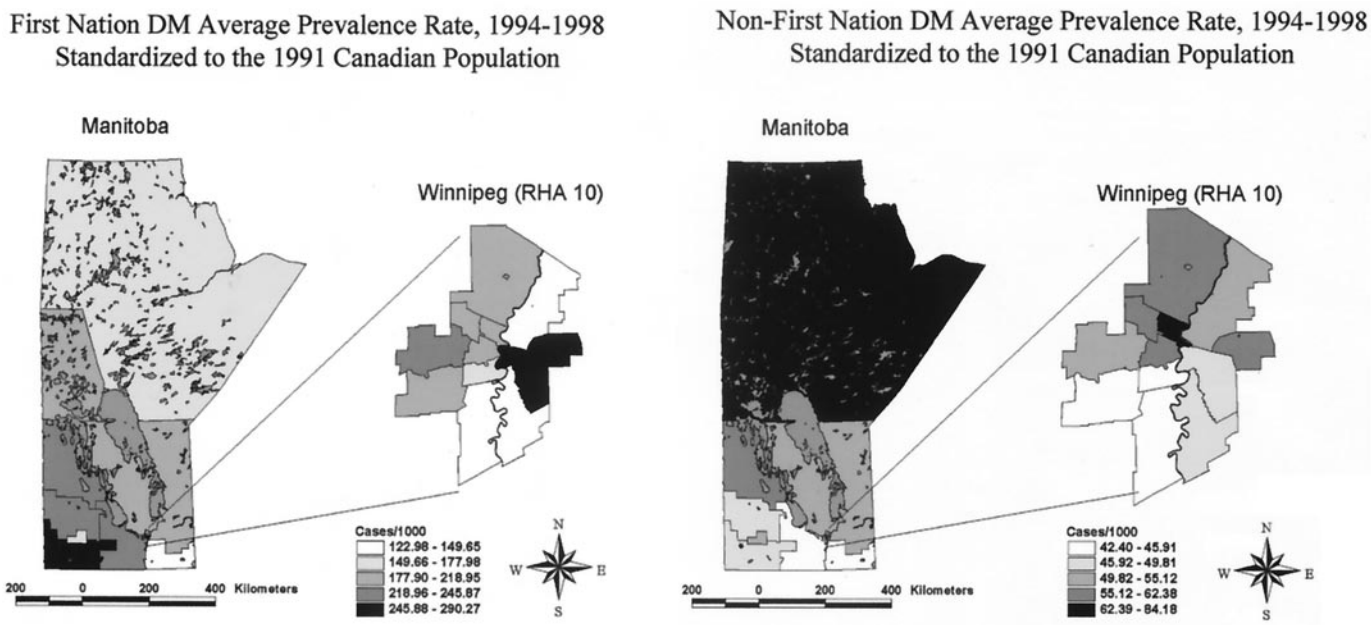

Figure 2—*Geographic variation in diabetes (DM) prevalence. First Nation population compared with non–First Nation population.*

rates (standardized to the 1991 Canadian population) of diabetes in the Sandy Lake First Nation population of 280/1,000 and 242/1,000 for women and men, respectively. This compares with rates of 248/1,000 and 209/1,000 for First Nation women and men observed in this study. Schraer et al. (5) and Burrows et al. (6), drawing upon data derived from a variety of patient registries, observed somewhat lower age-specific prevalence rates in American Indians and Alaska Natives between 1990 and 1997. Consistent with this study, however, both Schraer et al. (5) and Burrows et al. (6) observed increasing prevalence of diabetes over time.

It is important to note that prevalence comparisons between these studies are difficult because of differences in data capture methodologies, age ranges, time frames, and age standardization techniques used.

This study has a number of methodological limitations that must be kept in mind when interpreting its results. First, it has relied exclusively on data derived from administrative databases to estimate diabetes prevalence and incidence rates. Since this approach depends upon diabetes cases being recognized, diagnosed, and recorded through routine interaction with the health care system, it most certainly underestimates the actual incidence and prevalence of diabetes. As described by Young and Mustard (8) and Harris et al. (9), up to one-third of diabetes cases are undiagnosed. Some of the increasing prevalence of diabetes observed in this study may actually have been due to movement of individuals from the undiagnosed diabetes pool as a result of increased screening by health care providers. Also, as a result of the recent lowering of the cutoff point for diagnosing diabetes in Canada from a fasting plasma glucose level of 7.8 to 7 mmol/l, the pool of undiagnosed individuals with diabetes has increased. Movement of individuals from the undiagnosed to the diagnosed diabetes pool may be an important factor in driving future increases in observed diabetes prevalence. Despite likely underestimation of diabetes incidence and prevalence, the specificity of our approach is high when compared with existing registries of type 2 diabetes (3) and to abstracted patient charts of randomly selected physicians (7).

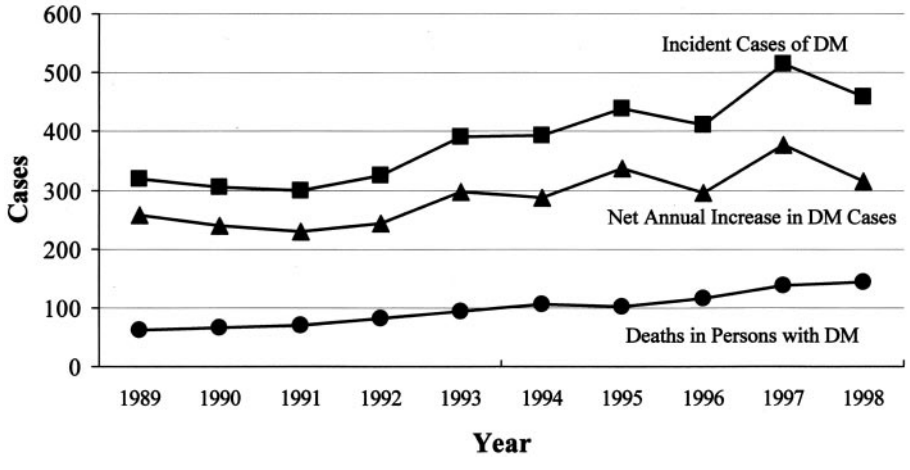

Figure 3— *Incident cases of diabetes (DM), diabetes-related deaths, and net annual increase in diabetes cases, registered First Nation, Manitoba, 1989–1998.*

Second, the restriction of First Nation designation in this study to those individuals registered under the Indian Act of Canada and the under-recording of First Nation status in the Manitoba Health Registry likely diminishes the observed differences between the First Nation and the non–First Nation population. This is probably not a major issue because those

individuals identified as First Nation are highly likely to be of First Nation ancestry, whereas those missed and thus classified as non–First Nation are unlikely to affect the rate in the much larger non–First Nation population.

Third, this study does not differentiate between type 1 and type 2 diabetes because the case definition for diabetes used in the generation of MDD from administrative databases is based upon ICD-CM-250. No subclassifications exist in these administrative databases, which would allow differentiation between type 1 and type 2 diabetes. However, given that type 2 diabetes makes up ~90–95% of all diabetes cases, the use of diabetes in this study is likely a valid proxy for type 2 diabetes (10).

The results of this study have two important implications for First Nation diabetes prevention and management programs. First, it appears that diabetes prevalence rates will almost certainly continue to rise in the Manitoba First Nation population over the next two decades. As illustrated in Fig. 2, as long as the number of incident cases of diabetes exceeds the number of deaths in individuals with diabetes, diabetes prevalence will continue to rise. The rapid aging of the currently very young First Nation population into high-risk older age-groups, paired with emerging life-prolonging diabetes treatments, will maintain the spread between incidence and mortality into the foreseeable future. Even if incidence rates were flat or declining due to a breakthrough in diabetes prevention, prevalence rates would continue to rise as incidence outpaces mortality. This observation is consistent with others (11,12) who are predicting worldwide increases in diabetes prevalence over the next several decades in all population groups.

As a result, the health burden due to all types of diabetic complications will likely continue to rise in the Manitoba First Nation population. This means that the health care and social service systems should start preparing now to provide the secondary prevention and support services and systems a large number of First Nation adults with diabetes are going to require to maintain quality of life. These include diabetes-screening programs, foot-care programs, accessible dialysis services, dietary counseling services, and enhanced infrastructure at the community level to facilitate independent living by adults with limited mobility and eyesight.

Second, "upstream" population-based primary prevention programs need to be aggressively implemented to ensure that diabetes incidence among the First Nation population begins to decrease in the future. The dramatically higher rates of diabetes in the Manitoba First Nation population as compared with the non–First Nation population highlight the urgency of this activity. Because diabetes appears to be closely related to the adoption by First Nation people of many aspects of the modern lifestyle including diet and low levels of physical activity, prevention programs that draw upon Aboriginal traditions and ways of life and that focus on the lifestyle habits of Aboriginal youth need to be implemented (13,14). Currently, almost 50% of the First Nation population is <20 years of age and still in the process of forming lifelong lifestyle habits that will affect their future susceptibility to developing diabetes and its complications. A number of very promising primary prevention programs that draw upon Aboriginal traditions and ways of life have been implemented across Canada (15–21).

The results of this study are also suggestive of a number of future research priorities. First, the observation in this study of lower diabetes prevalence in more northern and remote areas of the province suggests that living in these areas has a protective effect on diabetes. Further research is required to determine if this is due to a greater adherence to traditional lifestyle practices, such as hunting, fishing, and consumption of wild game, to broader community level factors, or to genetic factors.

Second, the reason for the higher prevalence of diabetes in First Nation women observed in this study also needs to be better understood. The relationship to earlier episodes of gestational diabetes should be investigated as one possible pathway that increases the susceptibility of First Nation women to diabetes.

In conclusion, this study has demonstrated the value of having accurate population-based information on the epidemiology of diabetes in the First Nation population. By providing information on the trajectory and the geography of the diabetes epidemic in the First Nation population and the intensity of the epidemic in comparison with non–First Nation populations, it provides important clues as to the magnitude and structure of the primary and secondary intervention programs that will be required to effectively manage this disease in First Nation people. It also highlights the important need to undertake further research into the community and individual-level factors that appear to place some First Nation population groups at lower risk for developing diabetes.

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