Epidemiologic features of diabetes mellitus among Indians in northwestern Ontario and northeastern Manitoba

T. Kue Young, MD, MSc, FRCPC
L. Lynn McIntyre, MD
Joseph Dooley, MD
Jude Rodriguez, MD

This descriptive epidemiologic study of diabetes mellitus among Indians in northwestern Ontario and northeastern Manitoba provided estimates of the prevalence of diagnosed cases: 28/1000 overall, 46/1000 for those aged 15 to 64 years and 96/1000 for those aged 65 years and over. Diabetes was more prevalent among women than men but was rare in children. More than half of the existing cases had been diagnosed within the last 5 years studied (1978–82). Comparisons with Canadians nationally and other North American Indian groups were made with caution owing to the different methods of case ascertainment. Duration of disease and pre-existing hypertension were found to be statistically significant risk factors for the development of complications of diabetes in this population.

Enquête épidémiologique sur le diabète sucré chez les Amérindiens du nord-ouest de l'Ontario et du nord-est du Manitoba. Les prévalences estimatives des cas reconnus par 1000 sujets sont de 28 pour l'ensemble, de 46 pour ceux qui sont âgés de 15 à 64 ans, et de 96 à partir de 65 ans. Le diabète est plus fréquent chez les femmes que chez les hommes; il est rare chez les enfants. Plus de la moitié des cas ont été reconnus dans la dernière tranche de 5 ans recensés, soit 1978 à 1982. Vu les différences dans les méthodes de dépistage, il est difficile de comparer ces chiffres avec ceux qui ont été donnés pour l'ensemble des Canadiens et pour d'autres groupes d'Amérindiens. Il existe un rapport significatif dans la population étudiée entre la durée de la maladie et l'hypertension artérielle pré-existante, d'une part, et le risque de survenue des complications du diabète d'autre part.

Among observers of native health care in Canada it is widely perceived that chronic diseases such as diabetes mellitus are being recognized more frequently, especially over the last two decades. There is a considerable literature on diabetes among American Indians. West[1,2] reviewed over 100 papers covering some 80 tribes and concluded that diabetes was very rare prior to the Second World War but that an "epidemic" began among many tribes in the postwar years.

In Canada, apart from several studies among Indians and Inuit in the Northwest Territories,[3-5] published data on the prevalence of diabetes among Indians are scarce. This paper reports on the pooled results of two descriptive epidemiologic studies of diabetes among the Cree and Ojibwa (Saulteaux) Indians in northwestern Ontario and northeastern Manitoba.

Methods

Study population

The area studied included 30 isolated communities scattered in the eastern subarctic boreal forest of Central Canada (Fig. 1). Fourteen thousand Algonkian-speaking Cree and Ojibwa (Saulteaux) Indians live in the area, and their health services are provided primarily by the Medical Services Branch of the Department of National Health and Welfare. Since the early 1970s visiting physician services to these communities have been provided by the University of Toronto Sioux Lookout Project and the University of Manitoba North-

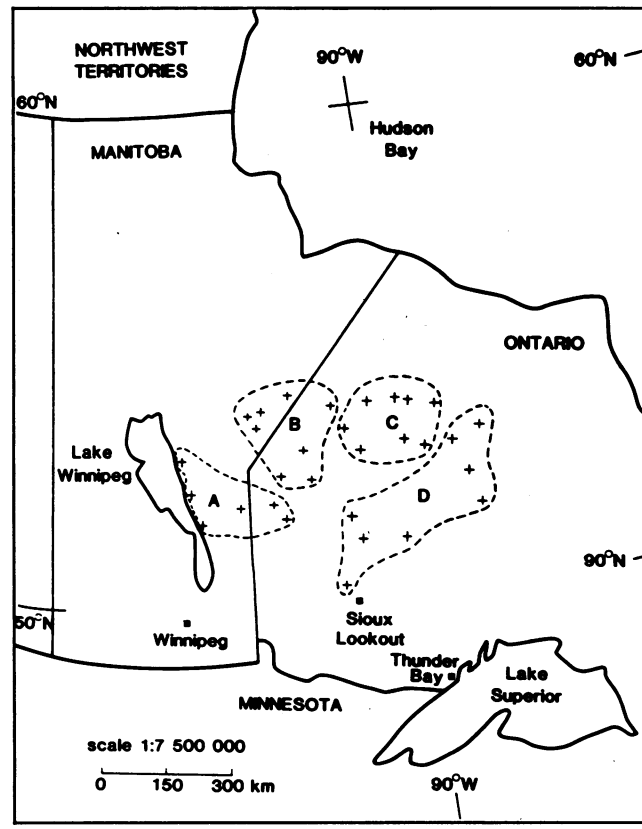

Fig. 1—Map of study communities in northwestern Ontario and northeastern Manitoba.

From the University of Manitoba Northern Medical Unit and the University of Toronto Sioux Lookout Project

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Reprint requests to: Dr. T. Kue Young, Assistant professor, Department of Social and Preventive Medicine, University of Manitoba, 750 Bannatyne Ave., Winnipeg, Man. R3E 0W3

ern Medical Unit. The health care delivery system and general pattern of health of the region have been described elsewhere.[6-8]

Sources of data

All Indians living in the study area on Jan. 1, 1983 for whom the federal Indian Health Services had made a diagnosis of diabetes mellitus (code 250 in the International Classification of Diseases[9]) were included in a case registry. We excluded those with gestational diabetes, so-called secondary diabetes or impaired glucose tolerance.

For the Sioux Lookout Zone, in northwestern Ontario, cases were ascertained from the following:

- Separations from the Sioux Lookout Zone Hospital, the secondary care facility for all the communities in the zone; the records have been computerized since 1975.
- Records of ambulatory care visits to outpost nurses and visiting physicians in the communities; these records were available from computerized logs dating from 1978.
- Chronic disease card indices, kept at each peripheral health unit for follow-up of patients in the communities.
- Drug dispensing records kept by the zone hospital pharmacy.

For communities in northeastern Manitoba served by the Northern Medical Unit the sources included chronic disease card indices, maintained in the communities by the outpost nurses, and a central computerized listing of patients with diabetes provided by the zone office of the Medical Services Branch, in Winnipeg.

The clinical histories of the patients so identified were abstracted from their medical files. The biochemical criteria of the National Diabetes Data Group (NDDG)[10] were used to confirm the diagnosis of diabetes mellitus. Further classification of the disease into insulin-dependent and non-insulin-dependent forms was not attempted, although the type of therapy was recorded.

Prevalence rates were calculated for the entire group of patients. In addition, pre-existing obesity, risk factors for the development of complications, and changes in therapy were studied in the patients living in the Sioux Lookout Zone. With univariate stratified analyses performed by the methods of Mantel and Haenszel[11] and Miettinen[12] we analysed five risk factors while controlling for age and sex, with all complications combined and classified into "present" or "absent".

Results

Prevalence of diabetes

An overall prevalence rate of 28/1000 was found for this population. Table I shows the age–sex distribution of the patients and the age-group-specific prevalence rates. Female patients outnumbered male 2.5 to 1.

Table I—Age–sex distribution of Indians with diabetes mellitus and age-group-specific prevalence rates, northwestern Ontario and northeastern Manitoba

Age group (yr)	No. of patients			% of all patients	Prevalence rate per 1000 population
	Male	Female	Total		
0–14	0	3	3	0.8	0.5
15–24	2	10	12	3.1	4.0
25–44	42	107	149	38.7	53.1
45–64	48	117	165	42.9	125.5
65+	17	39	56	14.5	95.7
Total	109	276	385	100.0	27.5

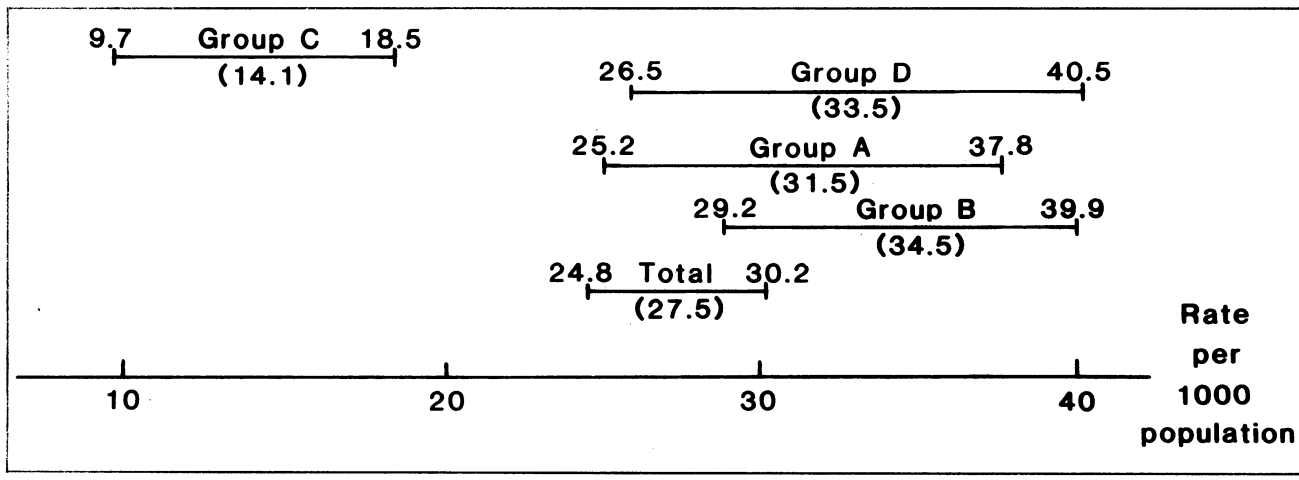

Fig. 2—Mean prevalence rates (in parenthesis) of diabetes in the four groups of communities, with 95% confidence intervals.

The prevalence rate varied among the communities. To reduce the instability of rates due to the small numbers involved, we grouped the communities to reflect, when possible, traditional kinship associations. The prevalence rates for the four groups of communities, with their 95% confidence intervals, are shown in Fig. 2. (The 95% confidence interval was determined by the formula $1000(d \pm 1.96\sqrt{d})/n$, where n was the population and d the number of patients with diabetes.) One group (C) in northwestern Ontario had a significantly lower prevalence rate than the others.

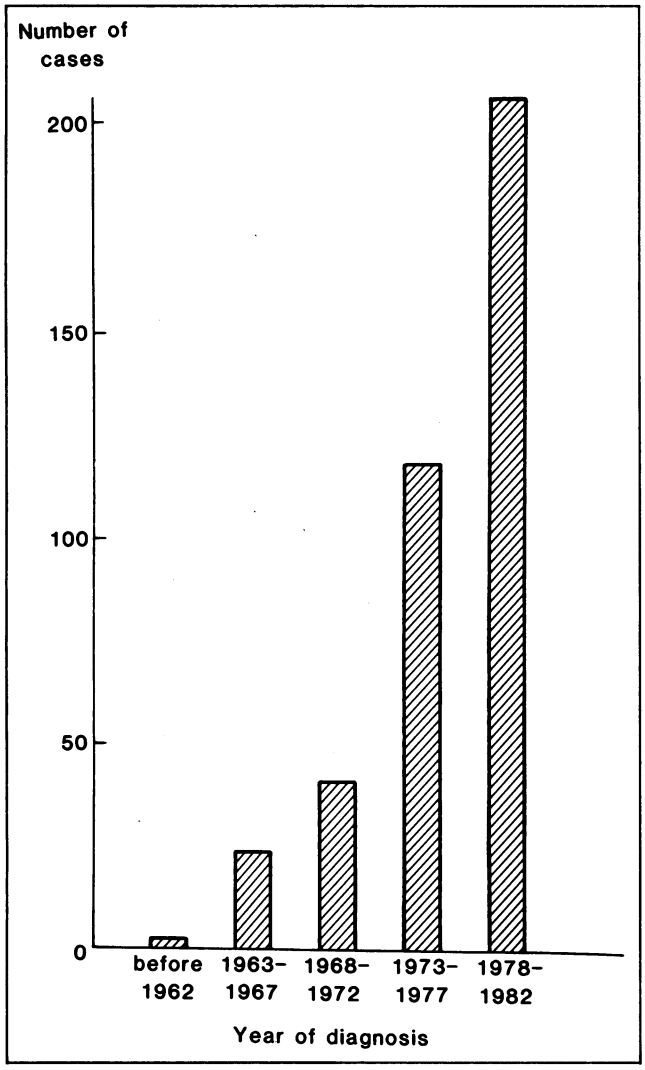

Fig. 3—Year of diagnosis of diabetes in the two regions.

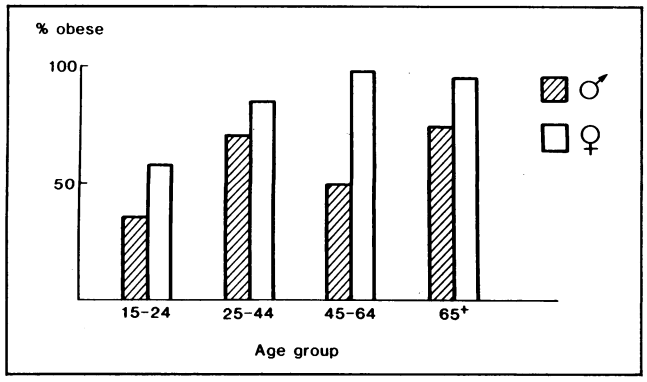

Fig. 4—Prevalence of obesity (according to the criteria of the National Diabetes Data Group) among the patients in the Sioux Lookout Zone, in northwestern Ontario, at the time of diagnosis.

Duration of disease

More than half of the cases had been diagnosed within the most recent 5 years studied (Fig. 3). There had not been any significant change in the age distribution of the patients between the previous years and this recent period.

Association with obesity

Among the patients in the Sioux Lookout Zone weight and height were recorded in the files of only 98% and 74% respectively. For those aged 15 years and over the body mass index (BMI) — (weight in kilograms)/(height in centimetres)^2 — ranged from 18 to 52. The BMI is not a meaningful index for children and therefore was not computed for patients under the age of 15 years. The NDDG classified as obese any person with diabetes who had a BMI of 27 or over if male or 25 or over if female. By these criteria 59% of the adult male and 84% of the adult female patients in the Sioux Lookout Zone could be considered obese (Fig. 4).

As an alternative way of measuring the prevalence of obesity we compared the patients' weight for age and weight for height for age with the Canadian national standards provided by the Nutrition Canada Survey of the early 1970s.[13] These measures were within the top quartile of the national standards at the time of diagnosis for 46% of the male and 71% of the female patients (including those under 15 years of age) in the Sioux Lookout Zone.

Risks of complications

About 30% of the patients in the Sioux Lookout Zone (37% of the males and 27% of the females) had one or more complications of diabetes: 17% had ischemic heart disease, 7% cerebrovascular disease, 6% peripheral neuropathy and 5% nephropathy according to physicians' diagnoses recorded on the charts; no special standardized examinations were performed to confirm these diagnoses. By univariate stratified analyses we found that a duration of diabetes of 5 years or longer and the presence of hypertension at the time diabetes was diagnosed were associated with a statistically significant twofold increase in the risk of any complications of diabetes developing in the patients of this region (Table II). Weight, fasting plasma glucose level and the presence of symptoms were not found to be significant risk factors.

Treatment

At the time diabetes was first diagnosed, over half of the patients in the Sioux Lookout Zone were treated with oral hypoglycemic agents, 37% with diet alone and 9% with insulin.

At some time during the course of their illness insulin was prescribed for a total of 17% of the patients in this region. Those who had glycosuria and ketonuria at the time of diagnosis were more likely to require some insulin. No association was found between insulin use and duration of disease or weight. Few of the insulin users could be considered as having true insulin-dependent diabetes, with the possible exception of those whose disease first appeared before the age of 15 years. Episodes of ketoacidosis were documented in only four patients.

Discussion

The prevalence of diabetes in the group of Cree and Ojibwa Indians studied may be compared with that of Canadians nationally and with that of other Indian tribes in North America. However, one should be cautious in such comparisons and take into account the different methods of case ascertainment — self-reports (as in the Canada Health Survey[14]), registers of physician-diagnosed cases (as in this study) and mass screening. The biochemical criteria used also varied widely.

According to the Canada Health Survey, in the late 1970s the prevalence rate of diabetes among Canadians was 15/1000 for those 15 to 64 years of age and 67/1000 for those 65 and over, with an overall male:female ratio of 1:1.5. The corresponding rates for the Indians we studied were higher, at 46/1000 and 96/1000 respectively, and female patients outnumbered male 2.5 to 1. Although we did not attempt to classify diabetes into insulin-dependent and non-insulin-dependent types, Table I shows that diabetes was uncommon among the Indian children.

Among North American Indians the prevalence of diabetes is higher in the Cree–Ojibwa than in the Athapaskan Indians in Alaska[15] but far below that in the Pimas[16] and many United States tribes.[1] There are very few published data on geographically well defined Indian groups in Canada. An unpublished study from Saskatchewan estimated the prevalence rate of diabetes among Indians in that province to be 14/1000 overall and 34/1000 among those aged 20 years and over (D. Gillis, Medical Services Branch, Department of National Health and Welfare, 1980). A survey of Dogrib Indians in the Northwest Territories, among whom clinical diabetes was reportedly unknown, showed that 13% of male and 7% of female adults had 2-hour plasma glucose levels over 200 mg/dL (11.1 mmol/L) and that 2% and 1% respectively had fasting levels greater than 140 mg/dL (7.8 mmol/L).[5]

Our study was based on cases that had been diagnosed in a well defined remote population. The method of case selection had a high specificity, since the application of NDDG criteria to cases previously identified probably eliminated false-positive cases. It is, however, obvious that without population screening with standardized glucose tolerance tests, many cases may have been missed. It has been suggested that for every known case there are at least two undetected cases.[17]

This was a prevalence rather than an incidence study. Nevertheless, with over 50% of the cases diagnosed within the last 5 years of a 25-year period, a dramatic increase in incidence has probably occurred, even though the effects of migration and mortality among persons with diabetes are not known in this population. Improved medical care may have led to an increased recognition of the disease, but the similar increase in the prevalence of diabetes in other aboriginal populations in Oceania and the New World has been attributed to accelerated environmental and dietary changes.[1,18] Direct evidence supporting this hypothesis was not available from our study. However, it is now recognized that nationally obesity is the most important nutritional

Table II—Analysis of risk factors for the development of complications of diabetes, with adjustment for age and sex, in patients in the Sioux Lookout Zone, northwestern Ontario

Risk factor	Patients: Total no.	Patients: No. (and %) with complications	χ^2†	Odds ratio, adjusted for age and sex (and 95% confidence limits)
Duration of illness, yr				
≥ 5	82	34 (41)	4.50‡	2.11 (1.06, 4.20)
< 5	107	23 (21)		
Blood pressure, mm Hg				
≥ 140/90	69	29 (42)	4.10‡	2.04 (1.02, 4.10)
< 140/90	119	28 (24)		
Weight, percentile				
≥ 75th	121	35 (29)	1.05	1.51 (0.69, 3.30)
< 75th	65	20 (31)		
Fasting plasma glucose level, mg/dL				
≥ 300	25	9 (36)	0.12	1.17 (0.48, 2.84)
< 300	152	44 (29)		
Symptoms				
Present	79	19 (24)	2.95	0.54 (0.26, 1.09)
Absent	103	38 (37)		

*The totals for the various risk factors are not equal because the pertinent data were unrecorded in different numbers of cases.
†Mantel–Haenszel statistic; ‡denotes $p < 0.05$.

problem among Indians, especially women, as was evident from the Nutrition Canada Indian Survey.[19] The role of obesity in the development of diabetes is well known.[17,20]

This study provided baseline epidemiologic data in one group of Canadian Indians. The influence of rapid social changes on the pattern of chronic diseases needs to be investigated, and diabetes can serve as an "indicator" disease. Future studies should involve Indians in different regions in both urban and rural environments, standardized glucose tolerance testing in screening surveys, and longitudinal designs.

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MEETINGS

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June 21–23

Pediatric Nutrition
Montreal
Dr. R.K. Chandra, Janeway Child Health Centre, St. John's, Nfld. A1A 1R8

June 23–28, 1985

Sixth Annual Congress of the Canadian Society of Laboratory Technologists
Convention Centre, Winnipeg
Mr. Kurt H. Davis, Director, Information Services, Canadian Society of Laboratory Technologists, PO Box 830, Hamilton, Ont. L8N 3N8; (416) 528-8642

July

July 7–10, 1985

Newer Developments in Assessing Clinical Competence
Ottawa
Dr. Ian R. Hart, Department of Medicine, Ottawa Civic Hospital, Ottawa, Ont. K1Y 4E9

August

Aug. 2–7, 1987

International Association of Forensic Sciences
Vancouver
International Association of Forensic Sciences, 801–750 Jervis St., Vancouver, BC V6E 2A9; (604) 681-5226

Aug. 8–10, 1985

Masters Game and Sports Medicine Symposium
Harbour Castle Hilton Hotel, Toronto
Masters Games, Box 1985, Stn. P, Toronto, Ont. M5S 2Y7; (416) 927-1985

Aug. 12–14, 1985

Third Terry Fox Cancer Conference on Cancer Prevention: Theory and Practice
University of British Columbia
Dr. H.F. Stich, British Columbia Cancer Research Centre, 601 W 10th Ave., Vancouver, BC V5Z 1L3; (604) 877-6010

Aug. 24–27, 1985

International Meeting on Immunogenetics of Endocrine Disorders
St. John's, Nfld.
Dr. Nadir R. Farid, Program chairman, International Meeting on Immunogenetics, Health Sciences Centre, Memorial University of Newfoundland, St. John's, Nfld. A1B 3V6; (709) 737-6300

Aug. 25–30, 1985

Fourth World Conference on Lung Cancer
Toronto
Fourth World Conference on Lung Cancer, Secretariat office, 342 MacLaren St., Ottawa, Ont. K2P 0M6; (613) 234-4398

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