

Diabetes mellitus in Mohawks of Kahnawake, PQ: a clinical and epidemiologic description

Louis T. Montour, MD, CM, CCFP
Ann C. Macaulay, MD, CCFP
Naomi Adelson, RN, MA

The authors report the rates of obesity, hypertension, hypercholesterolemia, smoking, and macrovascular and microvascular complications among Mohawks of Kahnawake, PQ, who have non-insulin-dependent diabetes mellitus. The data were derived from a study comparing rates of macrovascular and microvascular complications among the diabetic subjects and a nondiabetic group matched for age and sex. The data for both groups were collected by means of chart review, interview and body measurement. There were no important differences between the male and female diabetic subjects. Both sexes had high levels of obesity, hypertension, hypercholesterolemia and diabetic complications. A total of 86% of the diabetic subjects were obese; the rate was also very high (74%) among the nondiabetic subjects. The mean age at onset of diabetes, 59 years, was 10 years higher than that observed in Oneida Iroquois of Ontario. The rates of macrovascular disease among the diabetic subjects were higher than those found among Cree/Ojibwa in Ontario and Manitoba. Our findings add to the knowledge of non-insulin-dependent diabetes in North American Indians in Canada and show that there are differences between our Mohawk subjects and diabetic people of other native communities.

Dr. Montour is a family physician and medical director at Kateri Memorial Hospital Centre, Kahnawake, PQ, and an assistant professor of family medicine at the Herzl Family Practice Centre, McGill University, Montreal. Dr. Macaulay is an assistant professor of family medicine at the Montreal General Hospital, McGill University, and was formerly a family physician and medical director at Kateri Memorial Hospital Centre. Ms. Adelson is a doctoral student in medical anthropology at McGill University.

Reprint requests to: Dr. Louis T. Montour, Medical director, Kateri Memorial Hospital Centre, PO Box 10, Kahnawake, PQ J0L 1B0

On établit les taux d'obésité, d'hypertension artérielle, d'hypercholestérolémie, d'usage du tabac et de complications macrovasculaires et microvasculaires chez les Agniers de Kahnawake (Qué.) qui montrent un diabète non insulino-dépendant. Ces données proviennent d'un travail antérieur mettant en regard les taux de ces complications vasculaires chez les diabétiques et les non diabétiques appariés quant à l'âge et au sexe, fondé sur la revue des dossiers médicaux, les entrevues et les mensurations corporelles. Les diabétiques de l'un et l'autre sexe diffèrent peu sous ces rapports et montrent de forts taux d'obésité, d'hypertension artérielle, d'hypercholestérolémie et de complications du diabète. Ainsi 86% des diabétiques sont obèses, comme 74% des non diabétiques. L'âge moyen du début du diabète est de 59 ans, soit supérieur de 10 ans à ce qu'on a observé chez les Iroquois Onnéiouts de l'Ontario. Les taux de maladies macrovasculaires chez nos sujets sont plus élevés que chez les Cris et les Chippewas de l'Ontario et du Manitoba. Nous avons ajouté à la connaissance du diabète non insulino-dépendant des Amérindiens du Canada et souligné les différences entre nos Agniers et les diabétiques des autres tribus autochtones.

The prevalence of non-insulin-dependent diabetes mellitus is high in many North American Indian communities.¹ Because of the attendant illness, existence of these high rates causes concern among aboriginal people and health care workers employed in the aboriginal milieu. There is little published information on the prevalence rates of non-insulin-dependent diabetes among North American Indians in Canada or on other characteristics of the affected population.²⁻⁴

The Mohawks of Kahnawake have previously been described as having both high prevalence

rates of non-insulin-dependent diabetes³ and high rates of complications.⁵ In this paper we describe the rates of obesity, hypertension, hypercholesterolemia, smoking, and macrovascular and microvascular complications in this diabetic population, compare the male and female diabetic subjects and compare this group with other groups of diabetic North American Indians living in Canada.

Methods

The data for this paper were collected during the summer of 1985.^{5,6} All participants had to live in the Kahnawake territory, be at least 35 years of age, use the medical services of the community Kateri Memorial Hospital Centre (which services 92% of the population aged 45 to 64 years)³ and have either two parents or one parent and three grandparents of Mohawk descent.

The diagnosis of diabetes mellitus was based on numerous determinations of the blood glucose level, interpreted with the criteria of the National Diabetes Data Group as guidelines.⁷ Diabetes was diagnosed if the fasting plasma glucose level was 7.8 mmol/L (140 mg/dl) or greater on more than one occasion or if the plasma glucose level was 11.1 mmol/L (200 mg/dl) or greater 2 hours after eating.

Study participants were recruited, after radio publicity and word of mouth, by direct mailing and telephone calls. In June 1985, 132 of the 141 people known to have diabetes in the community met the above criteria, and 82 (62%) agreed to participate.

A nondiabetic comparison group matched for age and sex was randomly selected from the Kahnawake Membership Register (1985), in which people are registered by date of birth. If the person contacted declined to participate, the next person on the register was approached. Of the 261 people contacted, 101 (39%) agreed to be participants. All 101 had their glycosylated hemoglobin level measured; 7 people (7%) had a level greater than the designated cutoff point,⁸ 8, and were excluded from the study. (Subsequent investigation proved all seven to have diabetes.)

Information on the presence of hypertension, hypercholesterolemia, and macrovascular and microvascular disease was obtained by chart review. The charts of all 132 eligible diabetic people in the community and all 261 people invited to be in the nondiabetic comparison group were reviewed. In addition, all participants were questioned about their smoking habits in a face-to-face interview and had their height and weight measured by one of us (N.A.).

Body mass index was calculated as weight in kilograms divided by height in metres squared.⁷ Men with a body mass index of 27 or more and women with a body mass index of 25 or more were considered obese.⁷ Hypercholesterolemia was defined as a blood cholesterol level greater than

7.25 mmol/L (280 mg/dl) within the previous 5 years. Ischemic heart disease was defined as a physician's written chart diagnosis of myocardial infarction or angina or a history of coronary artery bypass surgery. Cerebral vascular disease was defined as a written diagnosis of stroke, transient ischemic attack or amaurosis fugax. Peripheral vascular disease was defined as a written diagnosis of ischemic foot, intermittent claudication or amputation. The diagnosis of diabetic retinopathy was accepted only if written in the chart by an ophthalmologist (consultant ophthalmologic services have existed since 1970). Diabetic neuropathy and nephropathy were written chart diagnoses, as was hypertension; no specific, standardized examinations were done to confirm these diagnoses.

Results

The age and sex distributions of the diabetic population are shown in Fig. 1. Of the 82 people with diabetes 48 were women and 34 were men. Table I shows the basic clinical characteristics of the men and the women. The two groups were similar in age at diagnosis of diabetes, duration of disease, mean body mass index, proportion with symptoms at the time of diagnosis, and rates of hypertension, hypercholesterolemia and smoking. Chart review showed that the 50 people with diabetes who did not participate had the same rates of hypertension and of macrovascular and microvascular disease as the 82 participants. Thus, except for history of smoking and body mass index we can confidently assert that the results in Table I reflect the entire diabetic community of Kahnawake. The nondiabetic subjects who declined to participate had the same rates of macrovascular disease and hypertension as the nondiabetic study participants.

There was a high prevalence of obesity in both the diabetic group and the nondiabetic group (Fig. 2). Our clinical impression, based on many years'

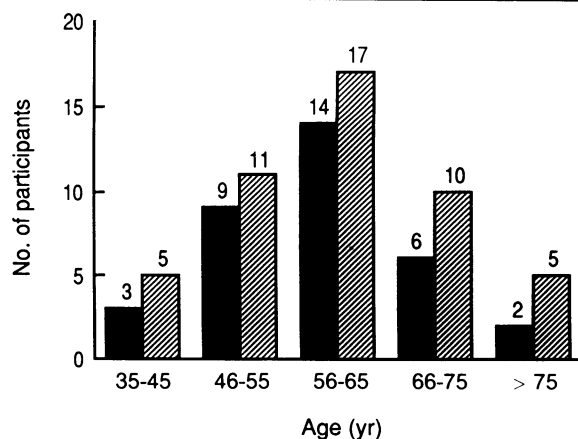


Fig. 1 — Age and sex distributions of diabetes mellitus in Mohawk community of Kahnawake, PQ. Black bars = men; striped bars = women.

experience, is that these high rates in the study participants reflect the prevalence of obesity in the community as a whole.

Discussion

The high rate of hypertension among our diabetic subjects parallels the known association of increased hypertension in white people with diabetes.¹² The proportion who smoked was the same as that for Quebec (36%) and Canada (33%) for the age group 35 to 64 years (Wayne Millar: unpublished observations, Canadian Labour Force Survey, 1983).

The high rate of obesity among our diabetic subjects, 86%, mirrors the rate of 80% reported for white adults with non-insulin-dependent diabetes.⁹ Our comparison group of nondiabetics also had distressingly high rates of obesity (74% overall). These rates are much higher than those observed in the Canada Fitness Survey (41% for men aged 30 to 69 years and 44% for women aged 30 to 69 years).¹⁰ Despite these high rates, there is a glimmer of hope. The mean body mass index at age 18 for the Kahnawake study population (based on reported weight) is 26 for men and 23 for women.⁶ This matches our clinical experience, because we know that most people in our community start out slim and add weight over the years. Thus, we hope to educate preteens and adolescents through primary prevention and encouragement of a non-diabetogenic lifestyle.¹¹ The main effort will be aimed at preventing obesity and increasing exercise in this population at high risk for non-insulin-dependent diabetes.

Both our male and female diabetic subjects had high levels of macrovascular disease. The observed prevalence rate of ischemic heart disease

in our diabetic study group, 48%, is the highest ever reported in a North American Indian community.⁵ The high rate among the women parallels the finding of increased rates of heart disease among white women with diabetes.¹³ The presence of diabetes appears to decrease the natural female protection against cardiovascular disease.¹³ All previous studies in North American Indian communities have shown low rates of ischemic heart disease, even in people with diabetes, although the rates are slowly increasing. We are unable to explain the high rates in our community. The interrelation of obesity, hypertension and non-insulin-dependent diabetes as risk factors for cardiovascular disease is complex.¹⁴

The higher rates of microvascular disease observed in our male subjects with diabetes may represent a true difference between the sexes or may be due to the small numbers of subjects.

There are few published data on diabetes in North American Indians in Canada. It is general knowledge that the prevalence of non-insulin-dependent diabetes is high in many North American Indian communities and that the rate of insulin-dependent diabetes is extremely low among North American Indians in the United States.¹ This certainly holds true for Kahnawake, where, at the time of our study, there were no cases of insulin-dependent diabetes. It is extremely important to start to recognize that within the overall descriptions of North American Indians in

Table 1 — Clinical characteristics of men and women with non-insulin-dependent diabetes mellitus in the Mohawk community of Kahnawake, PQ

Characteristic	Men (n = 34)	Women (n = 48)
Age, yr		
Mean at time of study (and extremes)	58.9 (36, 90)	60.2 (38, 82)
Mean at time of diagnosis	51.6	54.1
Mean duration of diabetes, yr	7.1	5.8
Mean body mass index	30	33
% with symptoms at diagnosis*	29	33
% with hypertension	65	75
% with hypercholesterolemia	13	19
% who smoked	32	27
% with vascular complications		
Ischemic heart disease	41	54
Cerebral vascular disease	15	13
Peripheral vascular disease	12	13
Retinopathy	27	8
Neuropathy	12	0
Nephropathy	6	2

*At least one of weight loss, polyuria, polydipsia and fatigue.

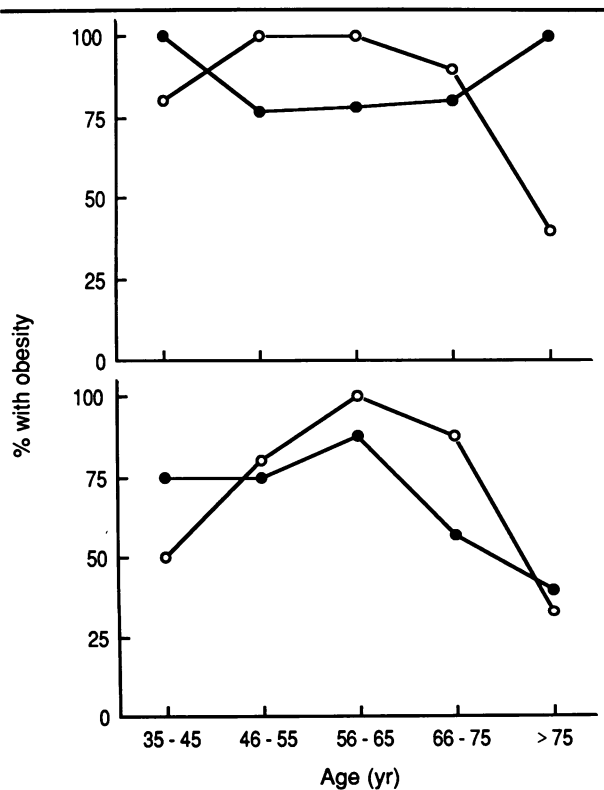


Fig. 2 — Prevalence rates of obesity by age among the 82 diabetic subjects (top) and the 94 nondiabetic subjects matched for age and sex (bottom). ● = men; ○ = women.

Canada there are not only similarities but also important differences. For example, our results show that the mean age at the time of diagnosis of non-insulin-dependent diabetes in this Mohawk Iroquois group is 10 years higher than that reported for Oneida Iroquois⁴ and that the rates of macrovascular disease are higher in our group than in Cree and Ojibwa.²

More information is needed, and future studies ideally should involve prospective collaborative research across the country. As an alternative to an expensive national study, regional assessments of the prevalence and incidence of non-insulin-dependent diabetes and its complications based on identical diagnostic criteria for diabetes and definitions of complications would not only increase the baseline knowledge of the disease but also help precisely define regional differences. Knowledge of these regional differences is essential to plan current therapeutic health care and to implement future preventive measures tailored to uniquely local needs.

We thank the Kateri Memorial Hospital Centre and staff, especially Mrs. Celina Montour. Our thanks also to Dr. Samy Suissa, Department of Epidemiology and Biostatistics, McGill University, for statistical advice, Dr. Eموke J.E. Szathmary (thesis supervisor for Naomi Adelson), Department of Anthropology, McMaster University, Hamilton, Ont., and Drs. Michael Klein and Mark Clarfield, Herzl Family Practice Centre, Sir Mortimer B. Davis Jewish General Hospital, McGill University, for practical support. Most important, our thanks to Kahnawakeronon, the people of Kahnawake, for their generous and enthusiastic cooperation.

We thank Kahnawake Community Social Services and the National Health Research and Development Program for funding.

References

1. West KM: Diabetes in American Indians and other native populations of the New World. *Diabetes* 1974; 23: 841-855
2. Young TK, McIntyre LL, Dooley J et al: Epidemiologic features of diabetes mellitus among Indians in northwestern Ontario and northeastern Manitoba. *Can Med Assoc J* 1985; 132: 793-797
3. Montour LT, Macaulay AC: High prevalence rates of diabetes mellitus and hypertension on a North American Indian reservation [C]. *Can Med Assoc J* 1985; 132: 1110, 1112
4. Evers S, McCracken E, Antone I et al: The prevalence of diabetes in Indians and Caucasians living in southwestern Ontario. *Can J Public Health* 1987; 78: 240-243
5. Macaulay AC, Montour LT, Adelson N: Prevalence of diabetic and atherosclerotic complications among Mohawk Indians of Kahnawake, PQ. *Can Med Assoc J* 1988; 139: 221-224
6. Adelson N: *Mohawk Diabetes, Obesity and Fat Patterning*, master's thesis, McMaster U, Hamilton, Ont, 1987

7. National Diabetes Data Group: Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. *Diabetes* 1979; 28: 1039-1057
8. Ferrell RE, Hanis CL, Aguilar L et al: Glycosylated hemoglobin determinations from capillary blood samples. *Am J Epidemiol* 1984; 119: 159-166
9. Working Group on Hypertension in Diabetes: Statement on hypertension in diabetes. *Diabetes* 1987; 10: 764-776
10. *Canadian Guidelines for Healthy Weights; Report of an Expert Group Convened by Health Promotion Directorate, Health Services and Promotion Branch, Health and Welfare Canada* (cat no H39-134/1988E), Minister of Supply and Services, Ottawa, 1988: Tables 11 and 12, pages 76-77
11. Montour LT, Macaulay AC: Diabetes mellitus and atherosclerosis: returning research results to the Mohawk community [E]. *Can Med Assoc J* 1988; 139: 201-202
12. Christlieb AR: Hypertension in the diabetic patient. In Marble A, Krall LP, Bradley RF et al (eds): *Joslin's Diabetes Mellitus*, 12th ed, Lea & Febiger, Philadelphia, 1985: 583-599
13. Królewski AS, Warram JH, Christlieb AR: Onset, course, complications, and prognosis of diabetes mellitus. *Ibid*: 251-277
14. Zimmet PZ, King HOM, Bjorntop A: Obesity, hypertension, carbohydrate disorders and the risk of chronic disease. *Med J Aust* 1986; 145: 256-262

Communicating electronically with CMAJ

For brief communications such as reviewer reports, inquiries, general correspondence and insertion orders for classified ads from within Canada (prepayment will still be required for ads from outside Canada) use either of the following means.

- Telex; our number is 053-3152
- Fax (facsimile) machine; our number is 613-523-0937

For communications up to eight double-spaced pages use

- Envoy 100; our user ID is CMAJ

We will consider for publication all letters-to-the-editor, editorials, "Platform" articles and book reviews sent by Envoy 100.

For manuscripts that exceed eight double-spaced pages or are accompanied by tables and figures use a courier.

If you're uncertain which means to use, telephone us, at 613-731-9331, ext. 2129 (or 2127 for classified ads).