Original Article

Diabetes prevalence and demographics in 25 First Nations communities in northwest Ontario (2014–2017)

Cai-Lei Matsumoto, MSc[1], Sheldon Tobe, MD, FRCP, MScCH[2,7], Yoko S. Schreiber, MD FRCPC MSc (Epi) CIP[3,4], Natalie Bocking, MD, CCFP, RCPSC[5], Janet Gordon, PND[1], Sharen Madden, MD, MSc, CCFP, FCFP[6], Josh Hopko[1], Len Kelly, MD, MClin Sci, FCFP, FRRM[8]

[1]Sioux Lookout First Nations Health Authority, [2]Division of Nephrology, U of T Associate Scientist, Institute of Medical Science, University of Toronto, [3]Division of Clinical Sciences, Northern Ontario School of Medicine at Sioux Lookout Meno Ya Win Health Centre, [4]Section of infectious diseases, Max Rady College of Medicine, University of Manitoba, Winnipeg, [5]Public Health and Preventative Medicine Specialist, Sioux Look-out First Nations Health Authority, Sioux Lookout, Ontario, [6]Division of Clinical Sciences, Northern Ontario School of Medicine, Thunder Bay, Canada, [7]Institute of Medical Science, University of Toronto, Toronto, [8]Sioux Lookout Meno Ya Win Health Centre, Ontario

Correspondence to:
Len Kelly,
lkelly@mcmaster.ca

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Abstract

Introduction: First Nations communities are known to have high rates of diabetes. The rural First Nations communities in northwest (NW) Ontario are particularly affected. Regional studies in 1985 and 1994 found a high prevalence of diabetes. More recently, they are estimated to have the highest prevalence in Ontario at 19%, double the provincial norm. The purpose of this study is to examine the epidemiology and prevalence of diabetes in the total population and cardiovascular comorbidities in the adult population of 25 First Nations communities in NW Ontario.

Methods: This retrospective diabetes prevalence study used primary care electronic medical record data for a 3-year period, 1 August 2014–31 July 2017. Diabetes prevalence was calculated for both the total and the adult (18+) populations and comorbid hypertension and dyslipidaemia were identified in adults.

Results: The age-adjusted diabetes prevalence for the total population was 15.1% versus a Canadian prevalence of 8.8%. The age-adjusted adult prevalence was 14.1%, double Canada's average of 7.1%. The average age of adults with diabetes was 52 years (±14.9); 57% were female. Comorbid hypertension (58%) and dyslipidaemia (73%) were common. Metformin was the most commonly used medication (58%), followed by insulin/analogues (23%) and sulphonylureas (13%).

Conclusion: The diabetes prevalence in the First Nations population of NW Ontario is double Canada's norm. Addressing it will require addressing relevant social determinants of health, including poverty and food security.

Keywords: Diabetes, First Nations, prevalence

Résumé

Introduction : Les communautés des Premières nations sont reconnues pour leur taux élevé de diabète, particulièrement les communautés rurales des Premières nations du Nord-Ouest de l'Ontario. Des études régionales réalisées en 1985 et 1994 ont révélé une forte prévalence de diabète. Plus récemment, on a estimé que la prévalence dans ces communautés s'élevait à 19 %, la plus forte en Ontario et le double de la norme provinciale. Cette étude visait à examiner l'épidémiologie et la prévalence du diabète auprès de la population totale et les comorbidités

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cardiovasculaires auprès de la population adulte de 25 communautés des Premières nations du Nord-Ouest de l'Ontario.
Méthodologie : Cette étude rétrospective visant à évaluer la prévalence du diabète a eu recours aux données sur 3 ans des dossiers médicaux électroniques des cliniques de première ligne, soit du 1er août 2014 au 31 juillet 2017. La prévalence du diabète a été calculée dans les populations totale et d'adultes (18 ans et plus) et l'hypertension et la dyslipidémie ont été dépistées en concomitance chez les adultes.
Résultats: La prévalence du diabète ajustée en fonction de l'âge dans la population totale était de 15,1 % par rapport à la prévalence canadienne de 8,8 %. La prévalence ajustée en fonction de l'âge chez les adultes était de 14,1 %, soit le double de la prévalence canadienne de 7,1 %. L'âge moyen des adultes diabétiques était de 52 (±14,9) ans; et 57 % des participants étaient de sexe féminin. L'hypertension (58 %) et la dyslipidémie (73 %) étaient courantes en concomitance. La metformine était le médicament le plus fréquemment utilisé (58 %), suivie de l'insuline/analogues (23 %) et des sulfonylurées (13 %).
Conclusion: La prévalence du diabète dans les populations des Premières nations du Nord-Ouest de l'Ontario est le double de celle du Canada. Pour régler la situation, il faudra se pencher sur les déterminants sociaux de la santé pertinents tels que la pauvreté et l'insécurité alimentaire.

Mots-clés: Diabète, Premières nations, prévalence

INTRODUCTION

First Nations communities are known to have high rates of diabetes, particularly the rural First Nations communities in northwest (NW) Ontario. Regional studies in 1985 and 1994 found a high prevalence of diabetes and in a 2019 International Credential Evaluation Service report (ICES), they are estimated to have the highest prevalence in Ontario, at 19%, double the provincial norm of 8%.[1-3] These communities also have higher rates of lower limb amputations (×7) and advanced kidney disease (×2).[4-6] An accurate description of the regional scope of diabetes is needed to design appropriate initiatives and establish a baseline from which ongoing changes in disease presence can be measured. The purpose of this study is to examine the epidemiology and prevalence of diabetes in the total and adult population and associated cardiovascular comorbidities in diabetic adults in 25 First Nations communities in NW Ontario.

METHODS

Study design

This retrospective diabetes prevalence study used primary care electronic medical record (EMR) data for a 3-year period, 1 August 2014–31 July 2017. Diabetes prevalence was calculated for both the total and the adult (18+) population. Comorbid hypertension and dyslipidaemia prevalence was calculated for the adult population.

Setting and participants

The setting is 25 remote First Nations communities in NW Ontario, with a total population of 24,493, including 16,170 adults (18+). Each community receives primary care services from a local nursing station, with regular visits from community physicians, supported by the Sioux Lookout First Nations Health Authority (SLFNHA). Patients were included who had at least 1 primary care visit, at either one of the 25 nursing stations, or in the Sioux Lookout clinic, who were being investigated or treated for diabetes. Patients under age 18 were not included in the analysis of comorbidities.

Sources of data

Since 2013, all primary care clinical visits, laboratory investigations and prescriptions have been recorded in the OSCAR EMR in use by the practices of 30 community physicians. Data extraction and analysis was performed by the SLFNHA information technology department (JH) and verified by its public health epidemiologist (CM). The SLMHC laboratory performs all regional laboratory testing, with results automatically entered into the OSCAR. Medication prescribing is done exclusively through OSCAR and is linked to regional pharmacies.

Extracted data included demographics, laboratory results and prescribed medications. A 3-year time frame was chosen as most patients

with chronic conditions have at least one primary care visit in 2 years.[7,8] Data collection protocol approximated the validated Canadian Primary Care Sentinel Surveillance Network methods, but used a glycated haemoglobin level (A1c) of 6.5% rather than 7.0%.[9,10] Administrative data (physician billing and hospital diagnoses) were not used, but the use of EMR prescription and laboratory data has been shown to render equivalent results.[7]

Variables

Demographic and laboratory data included age, gender, low-density lipoprotein-cholesterol (LDL-C) and A1c. Prescribed medications were identified by the World Health Organization Anatomic Therapeutic Classification system.[11] This coding identifies all glucose and lipid-lowering and antihypertensive medications.

Diabetes was defined as a recorded A1c ≥6.5 mmol/l or a prescription of a glucose-lowering medication; hypertension was identified by the prescription of an antihypertensive medication and dyslipidaemia by an elevated LDL-C ≥ 2.0 mmol/L or the prescription of a lipid-lowering medication.

Statistical methods

The prevalence of diabetes was adjusted to the 2016 Canadian census population. The total population prevalence provided a comparator to national values, but most of the analysis focused on the adult prevalence, allowing comparison with other First Nations and the estimation of comorbid hypertension and dyslipidaemia. Data were presented as mean and standard deviation for continuous variables and proportions for discrete variables.

Ethics

SLFNHA requested and approved the study. The Sioux Lookout Meno Ya Win Research Review and Ethics Committee (#16-15) and the Lakehead University Research Ethics Board (#161 15-61) approved the study.

RESULTS

The age-adjusted population prevalence was 15.1%, with an adult (18+) prevalence of 14.4%. A total of 2960 patients were identified with diabetes, including 2888 adults. A1c testing occurred in 32% of the total adult population (5161/16,170). Females received A1c testing more often, 57% (2942/5161), and constituted 57% of the adult diabetic population (1657/2888).

Adult diabetic patients had a mean age of 52 years, 11 years older than the average adult age and had double the rate of comorbid hypertension (58%) and dyslipidaemia (73%) [Table 1 and Figure 1].

The average adult A1c was 8.6 mmol/l; 29.5% were ≤7.0%. The most common glucose-lowering medication was metformin, followed by insulin and sulphonylureas [Table 2].

The greatest increase in age group prevalence occurred in females aged 30–40 years, from 8.9% at age 30–34 years to 20.2% at 35–39 years [Figures 2 and 3]. There was a wide range in the adult prevalence among the 25 communities; crude rates varied from 9% to 32%.

DISCUSSION

Prevalence

The 15.1% overall age-adjusted prevalence of diabetes in these 25 First Nations communities was higher than the 2017 Canadian prevalence of 8.8%.[12] While higher than national values, the prevalence is lower than that in other First Nations studies; our adult-specific age-adjusted prevalence of 14.4% is higher than the Canadian adult prevalence of 7.1%, but is lower than the crude adult prevalence of 27% in the James Bay Cree and 35% in a 2016 Manitoba First Nations screening study (our crude adult prevalence was 18%).[13-15] Methodological variations exist in these comparator studies; both relied primarily on A1c laboratory data. However, they used different cohorts: James Bay prevalence was estimated in the context of a proactive community-based diabetic programme, whereas a self-referred screening population was used in Manitoba.[14,15] It is not clear how these differences affect prevalence estimates, but First Nations communities in NW Ontario appear to have a lower diabetes prevalence than other First Nations. Our assumption that the 3-year study period we used would identify most patients with diabetes seemed appropriate; Grevier's Canada-wide primary care EMR-based study found that diabetic patients

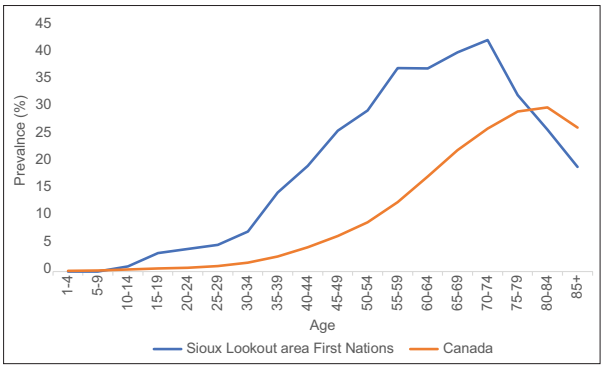


Figure 1: Diabetes prevalence by age in 25 First Nations communities in northwest Ontario 2014-2017 and Canada, 2013–2014

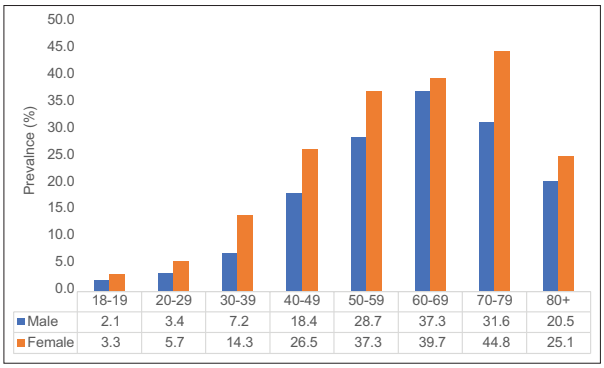


Figure 2: Adult (18+) diabetes prevalence by age and gender in 25 First Nations communities, northwest Ontario, 2014–2017.

Table 1: Demographics of total adult population and diabetic adult population in 25 First Nations communities, northwest Ontario, 2014–2017

Characteristics	Total adult population, *n* (%)	Diabetic adult population, *n* (%)
n (%)	16,170 (100)	2888 (18)
Mean age, SD	41 (16.9)	52 (14.9)
Female	8048 (50)	1657 (57)
Comorbidities		
Hypertension	3935 (24)	1675 (58)
Dyslipidaemia	5210 (32)	2108 (73)

SD: Standard deviation

Table 2: Adult use of diabetes medications (*n*=2888)

Class of drug	%
Biguanides (metformin)	58
Insulin/analogues	23
Sulphonylureas	13
DPP-4 inhibitors	3
Other medications	2
No medication	7

DPP-4: Dipeptidyl peptidase 4

were 1.4 times more likely to have a primary care visit in their 2-year study period and the diabetes programme in James Bay Cree communities found that 90% of the patients with diabetes had an A1c measurement within a 2-year period.[7,15]

Age and gender

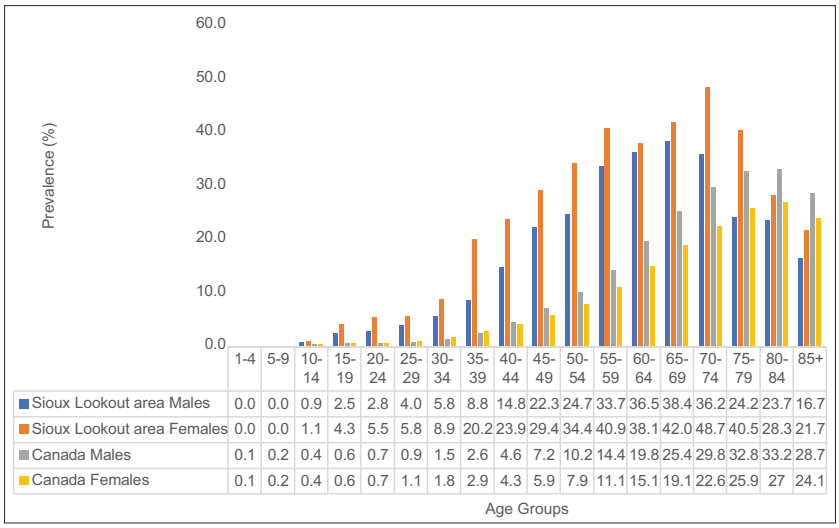
First Nations populations are known to develop diabetes at an earlier age than other Canadians. [16] The age-grouped results support this, demonstrating higher prevalence at younger ages [Figure 1]. Women were equally overrepresented (57%) in both the AIC-tested and diabetic populations. The largest diabetic cohort increase occurred in females in their 30s, where it doubled. Our regional population has a high birth rate, a high incidence of gestational diabetes and a high incidence of transition to overt Type 2 diabetes following gestational diabetes.[17-19] These contribute to the increased female prevalence of diabetes after age 30 and are consistent with a 1985 study of the same communities and other recent First Nations studies, which demonstrated a female preponderance[20-24] [Figure 2]. This contrasts with national values with a higher prevalence in males[25] [Figure 3].

Glycaemic control

The average A1c value in this adult diabetic population was 8.6%, higher than the 7.3%–8.2% in other primary care studies, with First Nations populations generally being at the higher end of that range[15,26-28] The target glycaemic control of A1c ≤7.0% was achieved in 29.5% of patients, compared to 39%–51% in other primary care studies.[28,29] Similarly, metformin was the most commonly prescribed glucose-lowering medication.[29,30]

Comorbidities

Hypertension co-prevalence (58%) in First Nations populations was similar to that in other Canadian diabetic populations (67.1%), but well below the 92% found in a 2011 study of 19 Canadian First Nations communities, whose methods included blood pressure measurement data in addition to antihypertensive medication records for 885 diabetic patients.[26,31] Dyslipidaemia co-prevalence of 73% was



	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+
Sioux Lookout area Males	0.0	0.0	0.9	2.5	2.8	4.0	5.8	8.8	14.8	22.3	24.7	33.7	36.5	38.4	36.2	24.2	23.7	16.7
Sioux Lookout area Females	0.0	0.0	1.1	4.3	5.5	5.8	8.9	20.2	23.9	29.4	34.4	40.9	38.1	42.0	48.7	40.5	28.3	21.7
Canada Males	0.1	0.2	0.4	0.6	0.7	0.9	1.5	2.6	4.6	7.2	10.2	14.4	19.8	25.4	29.8	32.8	33.2	28.7
Canada Females	0.1	0.2	0.4	0.6	0.7	1.1	1.8	2.9	4.3	5.9	7.9	11.1	15.1	19.1	22.6	25.9	27	24.1

Figure 3: Diabetes prevalence (cases/100) by age and gender in 25 First Nations communities in northwest Ontario 2014–2017 and Canada, 2013-2014.

between the 59% in Canada and 93% in other First Nations studies.[27,31]

Context

Estimates of diabetes prevalence tell only part of the story. The First Nations population experience increased diabetes-related morbidity and mortality.[32] Many factors contribute to this disease burden, including cultural and social determinants of health, poverty and food insecurity. Historic and political factors include inequities in employment and education, marginalisation, racism and intergenerational trauma resulting from governmental assimilation practices.[33-37] A similar disease profile exists in culturally and geographically distinct First Nations communities across Canada which reflects the impact of this shared history of colonisation and its ongoing detrimental effects.[33,36,37] Addressing these factors requires broad social and healthcare responses. The wide range of community-specific prevalence requires further examination to understand how genetic, epigenetic or environmental factors affect rates of diabetes.[38]

Limitations

A variety of methods and data are used in diabetes prevalence research. The Public Health Agency of Canada uses administrative data (hospital and physician diagnoses). We used laboratory and medication EMR data. Diagnostic codes for primary care visits were not available to us, as they are not automatically recorded in this EMR, which also precluded distinguishing between different classes of diabetes. We assumed a stable population as most communities are geographically isolated; but participation in the study did include northern patients who have moved to Sioux Lookout and some Sioux Lookout area residents.

CONCLUSION

The 25 First Nations communities in NW Ontario have a diabetes prevalence twice the Canadian average. Patients diagnosed with diabetes were younger, included more females and had significant levels of comorbid hypertension and dyslipidaemia. Social determinants of health and food security will need a culturally appropriate broad-based approach to address the environment in which diabetes thrives.

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Conflicts of interest: There are no conflicts of interest.

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