

COMMENTARY: TYPE 2 DIABETES EPIDEMIC IN FIRST NATIONS PEOPLE OF CANADA

Bilal B. Ayach, MSc, PhD; Holly Korda, MA, PhD

Diabetes is a chronic condition that results in the body's inability to either produce or respond to insulin. Abnormal insulin production and sensitivity lead to improper blood glucose levels and energy storage required for homeostatic organ maintenance. Over 151 million people worldwide, including 7% of the US and 5% of Canadian populations have been diagnosed with diabetes, and the prevalence varies greatly by race and ethnicity. However, since the end of World War II, the people with the greatest risk include First Nations people, including Canada's aboriginal, Inuit and Native Indian populations with up to a 5-fold greater prevalence than the general population. Prevalence can vary from 8% to 48% among the sexes and tribes. Understanding the prevalence and causes of this epidemic is immediately needed as diabetes precedes various other endocrine and cardiovascular diseases. Here we review the current understanding of diabetes risk in Canada's First Nations people in the hope to bring greater awareness among healthcare professionals and implementation of measures to prevent spread of this disease. (*Ethn Dis.* 2010;20:300–303)

Key Words: Type 2 Diabetes, First Nations, Canada, Aboriginal Health, Inuit, Population Health

PATHOLOGY OF DIABETES

Diabetes is a chronic condition that results in the body's inability to either produce or respond to the hormone insulin. Normally, insulin is produced by β -cells in the islets of Langerhans in the pancreas and is then secreted into the circulation in response to high blood glucose levels after a meal, and this stimulates the uptake of blood sugar into muscle and fat cells for storage.¹ This mechanism ensures that there are energy stores available for periods of starvation. This adaptation is considered an evolutionary benefit to the human species with specific thrifty genes that help in survival during periods without food.² When this insulin mechanism is impaired, either insulin is not being produced in sufficient levels or is not effectively signalling through its receptor, blood sugar levels remain high and lead to the development of diabetes mellitus. There are two forms of diabetes mellitus, insulin dependent (type 1) and insulin independent (type 2).¹ Type 1 diabetes is an autoimmune disorder in which the body's own immune system attacks and kills β -cells in the pancreas leading to a reduction or a complete cessation of insulin production. Patients with type 1 diabetes can manage their disease with daily injections of synthetic insulin. Type 2 diabetes is more common and accounts for 90% of cases and is characterized by the body's resistance to insulin. Type 2 diabetes normally occurs in adults and may be attributed to obesity, aging, or alcohol use. Uncontrolled, diabetes leads to other serious medical complications such as hypertension and cardiovascular diseases, retinal and renal damage, or nerve damage from wounds and ulcers, and a substantial increase in premature morbidity and mortality.¹

PREVALENCE OF DIABETES

Type 2 diabetes is the most common type of diabetes and exists in all populations with prevalence varying greatly across racial and ethnic groups, as low as 1% in Japan and as great as 40% in the Pima Indian population of Arizona. In 2000, more than 151 million people with diabetes worldwide were reported, and that number is predicted to reach 324 million in 2025.³ According to a 2005 report (2002 data) by the Centers for Disease Control and Prevention, approximately 21 million people in the United State (7%) were diagnosed with diabetes.⁴ Diabetes continues to be a significant health problem in Canada with approximately 4.8% of the population affected (Health Canada Report).⁵ Similar to the great increase in risk of diabetes in Pima Indians, Canada's First Nations people (aboriginal, Inuit and Native Indians) have also reported a higher prevalence of diabetes, averaging 8% in men and 13% in women across Canada, and as high as 25% in some areas. When age-adjusted to the Canadian population the prevalence was 3.6 to 5.3 times higher among First Nations men and women when compared to the general population.⁶

In one community of the Oji-Cree of Sandy Lake in northwestern Ontario, the prevalence of diabetes reached 25% among all adults and 80% among women aged 50–64 years.⁶ Rates among women aged 35 years or older in two Algonquin communities in Quebec and the Haida Gwaii in British Columbia were between 22% and 48% respectively, and 17% of all adults had type 2 diabetes.^{7,8}

Increasingly, type 2 diabetes is also being diagnosed in First Nations children and adolescents, even as young as 8 years of age in the Island Lake region of northeastern Manitoba, and the prevalence among females, aged 10–19 years has been reported to be 3.6%.⁹

From School of Medicine, St. George's University, Grenada (BA); and Altarum Institute (HK).

Address correspondence to Holly Korda, MA, PhD; Altarum Institute; 4 Milk St., 3rd Floor; Portland, Maine 04102; 207-772-1410; 207-772-1650 (fax); Holly.Korda@altarum.org

Similar to the great increase in risk of diabetes in Pima Indians, Canada's First Nations people (aboriginal, Inuit and Native Indians) have also reported a higher prevalence of diabetes, averaging 8% in men and 13% in women across Canada, and as high as 25% in some areas.

The early onset of type 2 diabetes is a significant change in trend than previously reported and especially so in the aboriginal populations across Canada and the United States. This is an emerging problem for the First Nations' aging population and a financial burden to the Canadian and First Nations' social healthcare system already strapped for funding.¹⁰ The rate of increase in occurrence of diabetes is alarming considering that before the 1950s type 2 diabetes was rare in Canada's aboriginal population and only truly emerged as an epidemic in the past two decades.⁶

Financial burden, not limited to the social healthcare system, can also influence individual family expenditure. In Canada, a person with diabetes typically acquires 2–5 times greater out-of-pocket financial costs (\$50 to \$200/month) for medical treatment than those without diabetes. First Nations people are typically unable to purchase the required drugs and do not get necessary treatment, and therefore suffer more illnesses from this disease.¹⁰

PREDISPOSITION TO DIABETES

The driving force behind the explosive diabetes epidemic worldwide and in

the Canadian First Nations population can be linked to environmental factors, such as adoption of sedentary lifestyle, changes in eating habits leading to unhealthy consumption of food, and obesity.² As recently as the early 20th century, First Nations' ancestors had a nomadic, non-agricultural lifestyle and hunted for food, with their diet mostly consisting of meat and fish. Importantly, the feast and famine cycles, where people would go for long periods of time before having enough food, was a common way of life.² However the more recent migration to urban centers for work or changes in the type of work due to industrialization led to reduced physical activity and adaptation of a diet high in energy, saturated fat and simple sugars (carbohydrates), leading to a rise in prevalence of obesity and diabetes in native men, women and children of all ages.¹¹ Obesity in the aboriginal population is one of the leading factors associated with the increase in diabetes. In 2002, 47.5% of aboriginals were reported as overweight compared to 15.2% of the Canadian population.¹²

Furthermore, another essential factor contributing to the greater obesity rate and eventually diabetes in Canada's First Nations people and aboriginals around the world is that they are genetically predisposed. The so-called thrifty genotype was hypothesized as having been selected for among past foraging populations, as in Aboriginal Canadian and Native American tribes. Those enduring common feast and famine cycles had a genotype that favored quick insulin activity resulting in greater fat storage in time of abundance.^{2,13,14} However, post-World War II, aboriginal populations no longer had to hunt for food and instead began a dietary intake similar to other Canadians. This short period of time spanning the change in lifestyle and activities did not allow for natural selection of new genes, and instead led to a greater development of obesity and type 2 diabetes.^{2,14} Some recognized

Mendelian genes involved in causing obesity and type 2 diabetes include Leptin, Leptin receptor, and HNF1A, as well as many other genes.^{2,13}

Education and socioeconomic states may also be a causative agent for obesity, leading to the onset of diabetes.¹⁵ First Nations people in Canada are less educated and more likely to live below the poverty line when compared to the Canadian population. These two variables, combined with limitation in health-care access and treatment,¹⁰ can also serve as an inhibitor for a healthier lifestyle, counselling on risk factors, and early screening of diabetes. Some aboriginal people may simply be unaware of the existence of diabetes. National and provincial programs for primary prevention and screening normally target the general population and may not be as effective in the aboriginal population. All of these variables predisposing the First Nations people and leading to a greater prevalence and earlier onset of diabetes must be taken into consideration when developing community health programs.⁶

APPROACHES TO REDUCING TYPE 2 DIABETES IN CANADA'S FIRST NATIONS PEOPLE

The Canadian government, working with the First Nations leaders across the country, has recognized the urgency of the diabetes epidemic in the aboriginal population. Since the beginning of the decade, the government has implemented programs to better monitor the prevalence of diabetes and has developed educational and health prevention programs intended to address and prevent this epidemic from worsening.^{5,10} In November 2005, a meeting between the leaders of the First Nations and the government of Canada resulted in the commitment of over \$5 billion dollars over the next 5 years to close the gap on education, health, housing and economic opportunities between ab-

originals and other Canadians. One of the major commitments to health care includes a goal to reduce the incidence of diabetes by 20% and 50% over the next 5 and 10 years respectively, and to double the number of healthcare professionals.¹⁰ This is an honorable commitment and the first step by national and First Nations governments to address this problem.

The First Nations Diabetes Report Card in 2006 also takes an important lead on suggestions for dealing with the diabetic epidemic within the aboriginal population.¹⁰ A holistic model approach to health and well-being maps out the intertwining relationships depicting the role of cultural, economic, social, and environmental factors that are needed to address this disease. This model has community at the center encapsulated by the art of medicine including spiritual, physical, mental and emotional health. These relationships directly influence six key areas of diabetes: prevention, treatment, education, policy development, research and surveillance.¹⁰ However, immediate action must be taken to quickly curb this health problem. For this goal to be successful the risks leading to diabetes, such as obesity, lifestyle and lack of education, must be prevented, and in addition new advancements in medicine must be used for designing personalized genomic medical treatment.

Primarily, more natives familiar with the language, culture, and way of life on the reserves must be recruited and trained as healthcare professionals. Aboriginal physicians, nutritionists, and nurses must be trained in order to provide the ideal treatment to their own communities. These new healthcare providers, working in partnership with the provincial Canadian healthcare force, can better understand, more accurately survey and monitor, and address the needs of the community in the holistic model. Because aboriginal physicians and nurses grew up in this community, speak the native language and understand the social

structure and the way of life, they can better design and implement preventive and treatment programs that will be understood, accepted and practiced in the community. They may also bring credibility and acceptance by the populations they serve as members of these same communities.

Obesity reduction programs must be in place in order to reduce body mass index (BMI) in this aboriginal population. As reported, 47.5% of aboriginals are overweight when compared to 15.2% of Canadians.¹² Since overweight and obesity are prediabetic symptoms, these must be addressed soon. One possibility is to implement a 30 minutes a day walking program (or other form of moderate physical activity) in primary and secondary schools, as well as at community centers. Even though this may not be enough to reduce BMI, it can drastically improve cardiovascular health. A 10-year study from Helsinki University demonstrated that 4 hours of exercise a week lead to an 80% reduction in the risk of developing diabetes. And those individuals who did the daily exercise and adapted to a new healthier diet, including increasing fiber intake, lost weight and had reported 100% prevention of diabetes.¹⁶ Furthermore, another study reported that 30 to 77 minutes of physical activity for patients already with type 2 diabetes impressively improved overall health and reduced the healthcare cost associated with diabetes treatment.¹⁷ One unique approach that these investigators suggest is using a step counter in order to provide a goal and a way of monitoring activity levels. One possible activity for aboriginals may include weekly traditional powwows, which normally feature dance, drumming, and plenty of social activities. Physical activity to reduce obesity is by far the cheapest and most effective way of preventing and treating type 2 diabetes. Healthcare providers working with aboriginal social service personnel should work together to implement and

promote such activities across the age spectrum of the aboriginal population, and target school children, working and non-working adults, as well as seniors.

Aboriginal nutritionists, working with other healthcare and educational providers will also need to play an important role in teaching healthier eating habits within the cultural means. This may include introducing more seeds and vegetables to the diet and a reduction in simple carbohydrates and trans fats. At the school level, foods contributing to weight gain, such as chips, candy, carbonated beverages, and fast food in the cafeteria must be taken out of the school in order to prevent an increase in childhood onset of diabetes. At home, better guidelines can be provided in the different languages and dialects on the type of food that should be consumed and which to avoid. One possibility is to involve the elders in seeking their guidance for traditional recipes more suitable with the nomadic way of life. Alcohol and cigarette consumption may also need to be addressed in order to better treat type 2 diabetes and reduce overall cost of treatment.

Prevention of diabetes should also be combined with new advanced medical breakthroughs. Scientists and healthcare professionals are only now better aware of genetic factors predisposing aboriginals to higher risks of obesity and diabetes and this can be used as a powerful tool to curb the onset and worsening of type 2 diabetes. We now know about the role of Leptin in signaling satiety in the brain. By identifying more mutations or genetic variances in the aboriginal population, we may be able to control the endocrine activity, for example, by producing synthetic substances that will have the same outcome. Likewise, gene therapy and other advancements are on the horizon and these should be studied in more detail and personalized to treat not only the Caucasians but also the aboriginal populations.

For the first time, the First Nation leaders have taken the lead and have implemented their own guidelines.¹⁰

The First Nations and Canadian governments have only recently begun to address the prevalence of type 2 diabetes across the country. They have taken important steps and have identified the risk and causative factors involved. For the first time, the First Nation leaders have taken the lead and have implemented their own guidelines.¹⁰ Now programs are being implemented in collaboration with members at the national, provincial and community levels. Within the next 10 years the efficacy and success of these programs will emerge. By addressing this problem now, we may be able to reverse economic and social damages caused by this disease and successfully benefit the First Nations population across the Canada.

REFERENCES

1. Dean L, McEntryre J. *The Genetic Landscape of Diabetes*. Bethesda, Maryland: National Library of Medicine; 2004.
2. Lazar MA. How obesity causes diabetes: not a tall tale. *Science*. 2005;307:373–374.
3. Cheng D. Prevalence, predisposition and prevention of type II diabetes. *Nutr Metab (London)*. 2005 Oct 18;2:29.
4. Centers for Disease Control and Prevention. National diabetes fact sheet: general information and national estimates on diabetes in the United States. 2003. Available at: <http://www.cdc.gov/diabetes/pubs/factsheet.htm>. Last accessed May 20, 2010.
5. Center for Chronic Disease Prevention and Control. Population and Public Health Branch. Health Canada. *Diabetes in Canada*. 2nd edition; 2002. Available at: http://www.phac-aspc.gc.ca/publicat/dic-dac2/english/01cover_e.html. Last accessed May 20, 2010.
6. Young KT, Reading J, Elias B, O'Neil JD. Type 2 diabetes mellitus in Canada's First Nations: status of an epidemic in progress. *CMAJ*. 2002;163(5):561–566.
7. Delisle HF, Ekoe JM. Prevalence of non-insulin-dependent diabetes mellitus and impaired glucose tolerance in two Algonquin communities in Quebec. *CMAJ*. 1993;148(1):41–47.
8. Grams GD, Herbert C, Heffernan C, et al. Haida perspectives on living with non-insulin-dependent diabetes. *CMAJ*. 1996;155(11):1563–1568.
9. Dean HJ, Young TK, Flett B, Wood-Steiman P. Screening for type-2 diabetes in aboriginal children in northern Canada. *Lancet*. 1998; 7:1523–1524.
10. Assembly of First Nations. *A First Nations Diabetes Report Card 2006*. Available at: <http://www.afn.ca/misc/diabetes-rc.pdf>. Last accessed May 20, 2010.
11. Thouez JP, Rannou A, Foggin P. The other face of development: native population, health status and indicators of malnutrition – the case of the Cree and Inuit of northern Quebec. *Soc Sci Med*. 1989;29(8):965–974.
12. Vanasse A, Demers M, Hemiri A, Courteau J. Obesity in Canada: where and how many? *Int J Obes (Lond)*. 2005;30(4):677–683.
13. Hegele RA. Genes and Environment in type 2 diabetes and atherosclerosis in aboriginal Canadians. *Curr Atheroscler Rep*. 2001;3(3):216–221.
14. Benyshek DC, Martin JF, Johnston CS. A reconsideration of the origins of the type 2 diabetes epidemic among native Americans and the implication for interventional policy. *Med Anthropol*. 2001;20(1):25–64.
15. Paeratakul S, Lovejoy JC, Ryan DH, Bray GA. The relation of gender, race and socioeconomic status to obesity and obesity comorbidities in a sample of US adults. *Int J Obes Relat Metab Disord*. 2002;26(9):1205–1210.
16. Laaksonen DE, Lindstrom J, Lakka TA, et al. Physical activity in the prevention of type 2 diabetes: the Finnish diabetes prevention study. *Diabetes*. 2005;54:158–165.
17. Di Loreto C, Fanelli C, Lucidi P, et al. Make your diabetic patients walk: long-term impact of different amounts of physical activity on type 2 diabetes. *Diabetes Care*. 2005;28:1295–1302.