

Increasing Incidence and Prevalence of Diabetes among the Status Aboriginal Population in Urban and Rural Alberta, 1995-2006

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ABSTRACT

Objective: To compare changes in diagnosed diabetes prevalence and incidence among Status Aboriginal men and women living in urban and rural areas of Alberta.

Methods: We compared trends in diabetes prevalence and incidence from 1995 to 2006 based on diagnostic codes from Alberta Health and Wellness (AHW) administrative records for adults aged 20 years and older. The AHW Registry file was used to determine registered Aboriginal status, as well as rural and urban residence (based on postal code). Multivariable logistic regression was used to compare diabetes rates over time, by sex and location of residence.

Results: Age- and sex-adjusted diabetes prevalence increased 35% in rural Status Aboriginals, from 10.9 (10.4-11.5) per 100 in 1995 to 14.7 (14.2-15.2) per 100 in 2006. Rates in urban Status Aboriginals increased 22% in the same time period from 9.4 (8.5-10.3) per 100 in 1995 to 11.5 (10.9-12.1) per 100 in 2006. The increases in prevalence were greater ($p < 0.001$) for men (43% and 40%) compared to women (30% and 12%) in rural and urban settings, respectively. Diabetes incidence increased 45% in Status Aboriginal men, from 7.4 (4.9-10.6) per 1000 in 1995 to 10.7 (8.3-13.5) per 1000 in 2006 in urban locations, compared to a 35% increase among Status Aboriginal men living in rural locations ($p = 0.628$). Among Status Aboriginal women, incidence increased by 25% for those living in urban locations, but did not change for those in rural locations ($p = 0.109$).

Conclusions: Prevalence and incidence of diagnosed diabetes were highest in Status Aboriginal women, but these rates have increased faster in men over the past decade, regardless of their location of residence.

Key words: Diabetes; epidemiology; rural health; Status Aboriginal

La traduction du résumé se trouve à la fin de l'article.

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Aboriginal Canadians, including First Nations, Metis and Inuit people, are recognized to be at increased risk for major health problems.¹ The increasing prevalence and incidence of diabetes mellitus among Aboriginal Canadians is well documented,¹⁻³ with prevalence reaching three to five times higher among Aboriginal Canadians compared to the non-Aboriginal population.¹⁻³ In remote Aboriginal communities, age-adjusted prevalence exceeds 25%,⁴ with increases of 45% over a 10-year period.⁵ A variety of factors are believed to be contributing to these increased rates, including genetic susceptibility⁶⁻⁹ and environmental factors associated with rapid socio-cultural changes, including change within urban Aboriginal populations as individuals move to the urban setting.¹⁰⁻¹³

Sex differences in diabetes epidemiology among Aboriginal compared to non-Aboriginals are also well recognized. In the general population, men have higher prevalence and incidence rates of diabetes compared to women,^{14,15} with the National Diabetes Surveillance System (NDSS) reporting diabetes prevalence rates of 5.4% and 4.9% for Canadian men and women, respectively.¹⁶ The opposite is true among Aboriginal Canadians.^{2,4,17} The reasons for these differences are not known, but may be due to higher rates of obesity among Aboriginal Canadian women,¹⁸ or higher rates of gestational diabetes mellitus, which is associated with an increased risk of subsequent type 2 diabetes in mothers and their offspring.^{2,19,20}

Lifestyle and location of residence are also important determinants in the development of chronic diseases such as diabetes.²¹⁻²³

Location is also important in terms of access to care and health outcomes. It has been demonstrated, for example, that individuals living in rural areas have increased treatment gaps and acute complications with their diabetes.²⁴⁻²⁶ Differences in health care utilization and costs between Aboriginal and non-Aboriginal Canadians have also been described.^{27,28} Little is known, however, about

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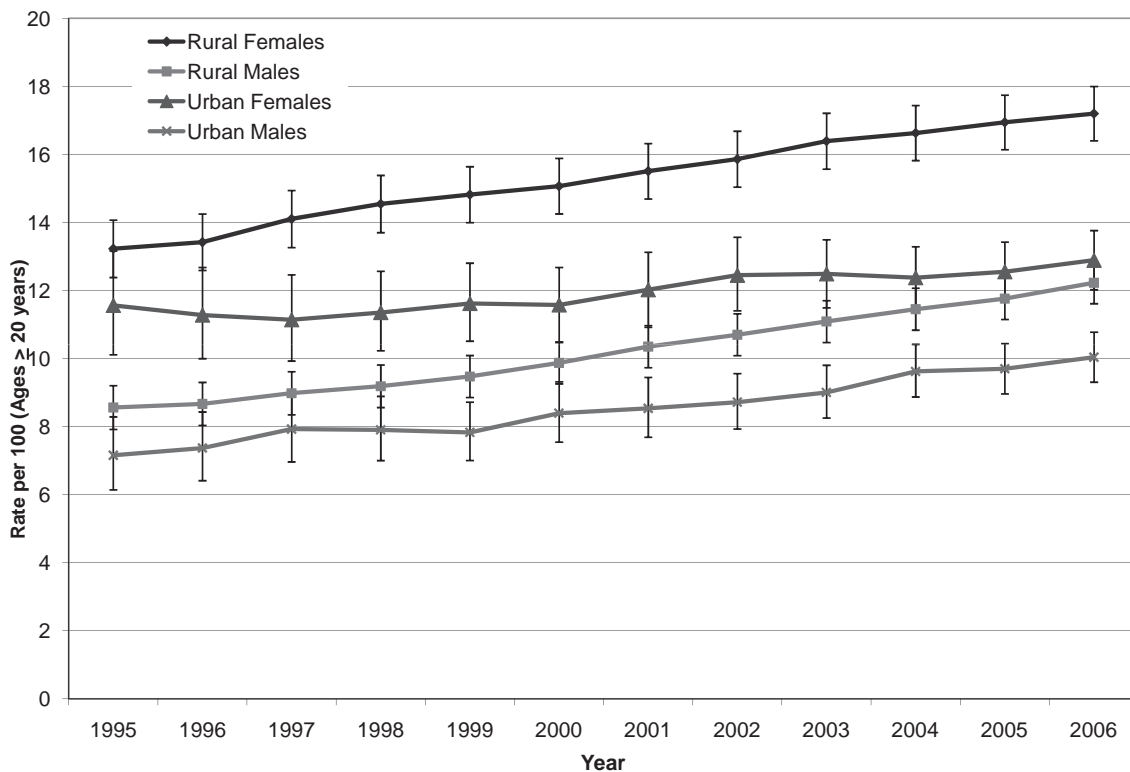
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Table 1. Diabetes Prevalence by Sex and Location of Residence among Status Aboriginal Canadians, 1995 and 2006

	Overall		Men		Women	
	Urban	Rural	Urban	Rural	Urban	Rural
1995						
People with diabetes (n)	836	1928	288	769	548	1159
Population (n)	17,943	27,093	8296	13,582	9647	13,511
Crude prevalence (per 100)	4.7	7.1	3.5	5.7	5.7	8.6
Adjusted* prevalence (per 100)	9.4	10.9	7.2	8.6	11.6	13.2
(95% CI)	(8.5-10.3)	(10.4-11.5)	(6.1-8.3)	(7.9-9.2)	(10.1-13.2)	(12.4-14.1)
2006						
People with diabetes (n)	2639	3954	1075	1684	1564	2270
Population (n)	35,929	35,102	17,215	17,519	18,714	17,583
Crude prevalence (per 100)	7.3	11.3	6.2	9.6	8.4	12.9
Adjusted* prevalence (per 100)	11.5	14.7	10.0	12.2	12.9	17.2
(95% CI)	(10.9-12.1)	(14.2-15.2)	(9.3-10.8)	(11.6-12.8)	(12.0-13.8)	(16.4-18.0)
% change in adjusted* prevalence	22.4%	35.0%	40.4%	42.8%	11.5%	30.0%

* rates are age-/sex-adjusted for Overall, and age-adjusted for Men and Women, using the 2001 Alberta population from the Canadian Census as standard.

Figure 1. Age-adjusted prevalence rates of diabetes among Status Aboriginal Canadians by sex and location of residence, 1995-2006



urban and rural differences in diabetes incidence and prevalence rates over time among the Aboriginal Canadian population. There is no one ideal population-based registry of all Aboriginal Canadians, but it is possible to monitor trends among those identified as Status Aboriginals within provincial health registries.¹⁶ Therefore, the objective of this study was to compare trends in diabetes prevalence and incidence for Status Aboriginal men and women in Alberta by urban and rural location of residence.

METHODS

Data sources and study population

Alberta Health and Wellness (AHW) administrative data were used for this study.¹⁷ These databases contain information on hospitalizations, physician services, and emergency department visits for all eligible residents of Alberta. Data pertaining to the age, sex and registered Indian status of all beneficiaries were obtained from Alberta Health Care Insurance Plan Central Stakeholder Registry file. The use of these data was reviewed and approved by the Health

Research Ethics Board for the University of Alberta and Capital Health.

Identification of Aboriginal status

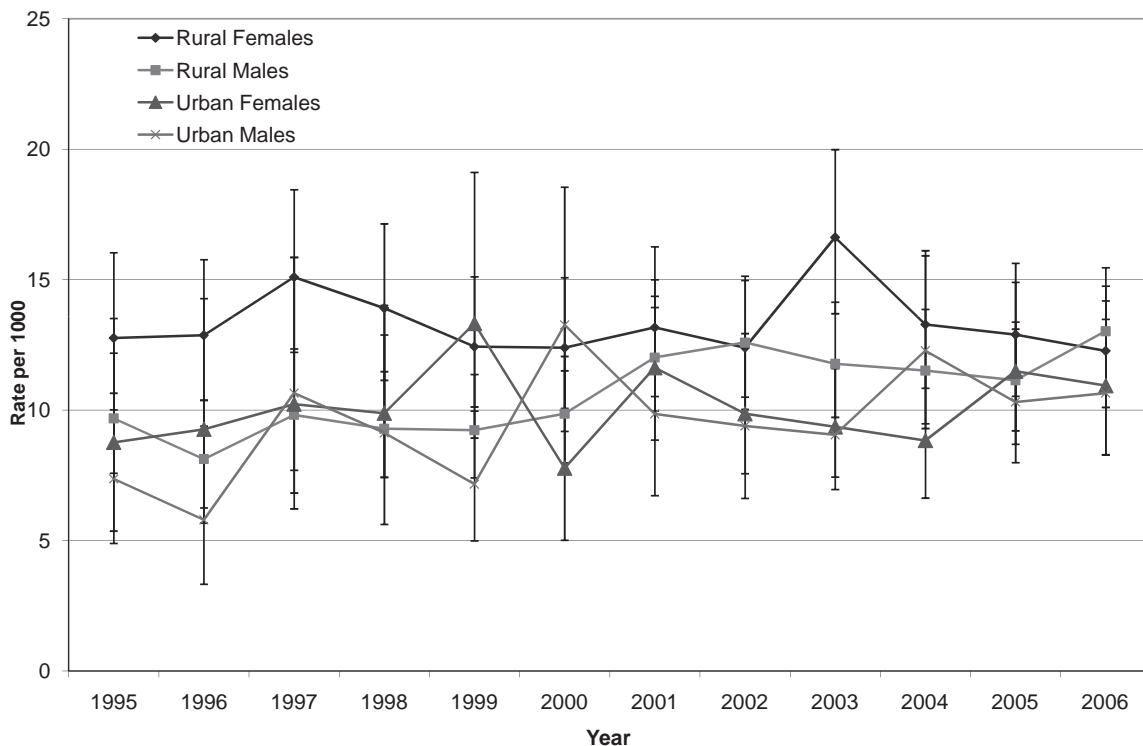
The term “Status Aboriginal” refers to a person residing in Alberta who is registered under the federal Indian Act²⁹ and entitled to Treaty Status with the Government of Canada. The Alberta personal health care number contains an “alternate premium arrangement” field, in which this health care coverage plan is specified. Provincial health care benefit premiums for people with Aboriginal status and their dependents are paid for by Health Canada. The AHW Registry file was searched from June 1994 to June 2006, and individuals with a Status Aboriginal identifier (First Nations or Inuit) were classified as Status Aboriginal; all others were classified as non-Status Aboriginal. Aboriginal people in Alberta who were not Registered – such as Aboriginal without Treaty status or Métis – were included in the non-Status Aboriginal group.

Table 2. Diabetes Incidence by Sex and Location of Residence among Status Aboriginal Canadians, 1995 and 2006

	Overall		Men		Women	
	Urban	Rural	Urban	Rural	Urban	Rural
1995						
New diabetes cases (n)	76	182	32	82	44	100
Population at risk (n)	17,183	25,347	8040	12,895	9143	12,452
Crude incidence (per 1000)	4.4	7.2	4.0	6.4	4.8	8.0
Adjusted* incidence (per 1000)	8.1	11.2	7.4	9.7	8.8	12.8
(95% CI)	(5.9-10.8)	(9.5-13.2)	(4.9-10.6)	(7.6-12.2)	(5.4-13.5)	(10.0-16.0)
2006						
New diabetes cases (n)	235	306	109	153	126	153
Population at risk (n)	33,525	31,454	16,249	15,988	17,276	15,466
Crude incidence (per 1000)	7.0	9.7	6.7	9.6	7.3	9.9
Adjusted* incidence (per 1000)	10.8	12.6	10.7	13.0	10.9	12.3
(95% CI)	(9.0-12.9)	(11.1-14.3)	(8.3-13.5)	(10.9-15.5)	(8.3-14.2)	(10.1-14.7)
% change in adjusted* incidence rate	33.8%	12.5%	44.7%	34.6%	24.8%	-3.9%

* rates are age-/sex-adjusted for Overall, and age-adjusted for Men and Women, using the 2001 Alberta population from the Canadian Census as standard.

Figure 2. Age-adjusted incidence rates of diabetes among Status Aboriginal Canadians by sex and location of residence, 1995-2006



Diabetes case definition

To identify cases of diagnosed diabetes, we applied the algorithm used by the NDSS,¹⁶ based on records for a hospitalization with an ICD-9 code of 250 (diabetes mellitus), selected from all available diagnostic codes on the Hospital Discharge Abstract for years before 2002, or equivalent ICD-10 codes (E10 to E14) of diabetes for years after 2002, or two physician claims with an ICD-9 code of 250 (diabetes mellitus) within two years. We did not exclude gestational diabetes cases. Adults age 20 years or older were included.

Incidence and prevalence

The index date was defined as the latest date of hospitalization, or the later of the two physician claims that contribute to the case definition.^{16,17} To identify an incident case of diabetes, a minimum diabetes-free observation period of 2 years was set as a requirement. Estimates of total population counts in Alberta were taken from the mid-year (i.e., June 30) AHW Registry data. For diabetes prevalence rates, we calculated the number of Status Aboriginal people identi-

fied with diabetes (the numerator) on a yearly basis for calendar years 1995 to 2006, and divided by the total Status Aboriginal population counts in Alberta (the denominator) for each calendar year. Similarly, annual incidence rates were calculated as the total number of new cases divided by the total Status Aboriginal population at risk, which was determined by the total Status Aboriginal population for the calendar year minus the previously prevalent diabetes cases.

Location of residence was based on the postal code for home address in the Stakeholder Registry, with the digit '0' (i.e., second digit) in the Forward Sortation Area (FSA) indicating a rural residence; all other digits indicated urban residence.³⁰ We did not classify residence based on home address being on- or off-reserve.

Statistical analysis

Diabetes incidence and prevalence rates were reported as crude and age- and sex-adjusted to the Alberta population from the 2001 Canadian Census³¹ in order to account for differences in popula-

tion age structure between location of residence or over time. 95% confidence intervals were calculated based on a gamma distribution using the methods of Fay and Feuer.³² The percent change in diabetes prevalence and incidence over time was calculated by dividing the difference between two adjusted rates by the earlier rates.

We used weighted logistic regression to test for trends in diabetes incidence and prevalence over time, using year as an ordinal variable. Independent variables included calendar year (1995 to 2006), sex, urban or rural location of residence and age (in 5-year bands: 20-24 years, 25-29, etc., to ≥ 85). We tested two-way interactions between sex, location and calendar year. Because of significant interactions between sex and year, we subsequently stratified analyses by men and women. All analyses were done with SPSS version 15.0.

RESULTS

Increasing prevalence

From 1995 to 2006, the age- and sex-adjusted prevalence of diabetes increased 22% among Status Aboriginal people in urban residences compared to 35% increase for those in rural locations (Table 1). Diabetes prevalence rates were higher among Status Aboriginal women compared to men in all years ($p < 0.001$), regardless of location of residence, although the increases across time were smaller (Table 1; Figure 1). For men, the age-adjusted prevalence increased 40% and 43% for urban and rural residences, respectively, while among Status Aboriginal women the increase was 12% for those with urban residence and 30% for those in rural areas (Table 1; Figure 1). In multivariable regression, the rates of increase were not significantly different between urban and rural for men ($p = 0.472$ for interaction between rural and year of follow-up) or women ($p = 0.203$).

Increasing incidence

Age- and sex-adjusted diabetes incidence rates increased by 34% for Status Aboriginal people with urban residences and 13% for those in rural areas (Table 2). Again, there was a significant interaction between sex and increasing incidence over time ($p = 0.006$). For men, the age-adjusted incidence was 7.4 (4.9-10.6) per 1000 for urban and 9.7 (7.6-12.2) per 1000 for rural in 1995, which increased to 10.7 (8.3-13.5) per 1000 and 13.0 (10.9-15.5) per 1000 in 2006. This represented 45% and 35% increases for urban and rural residences, respectively (Table 2; Figure 2). Among Status Aboriginal women, diabetes incidence increased by 25% for those with urban residence, but remained essentially unchanged for Status Aboriginal women in rural locations (Table 2; Figure 2). In multivariable regression adjusting for age, the increasing incidence rates were not significantly different between urban and rural for men ($p = 0.682$ for rural by year interaction). There was no significant interaction between location of residence and time for Status Aboriginal women ($p = 0.109$), nor were the incidence rates different across the follow-up period ($p = 0.579$). After adjusting for differences in the age structure, incidence rates across the full follow-up period were 22% (11-33%) higher for men and 27% (18-38%) higher for women in rural locations compared to urban locations ($p < 0.001$).

DISCUSSION

Using population-based administrative health care data, we observed substantial increases in the prevalence and incidence of

diabetes among Status Aboriginal people in Alberta. Diabetes prevalence was highest for Status Aboriginal women aged 20 and over, reaching a high of over 17 per 100 women living in a rural location in 2006. Prevalence has increased faster in Status Aboriginal men living in both rural and urban locations, however, with an increase of over 40% over the past decade. Likewise, diabetes incidence has also increased dramatically in Status Aboriginal men, but has remained relatively stable in Status Aboriginal women. We also noted that Status Aboriginal men and women living in rural locations have higher rates of both prevalence and incidence of diabetes than their urban counterparts. Between 1995 and 2006, diabetes incidence has remained stable among Status Aboriginal women living in rural locations such that, by the end of our follow-up period, these rates became almost equivalent to Status Aboriginal men living in rural locations.

The Status Aboriginal population is unique in that prior to the 1950s, type 2 diabetes was rare in Aboriginal populations.³³ At present, diabetes prevalence rates are over 2-3 times higher in Status Aboriginals compared to non-Aboriginals.^{2,17} As we witness this current diabetes epidemic unfold, we see that the Status Aboriginal population is becoming more similar to the non-Aboriginal population in terms of sex differences of diabetes rates.^{2,13} For example, it appears that diabetes rates in Aboriginal men may surpass diabetes rates in Aboriginal women in the next few years. Access to care and geographical factors have also been identified as important determinants of health for Aboriginal people,³⁴ and may be contributing to the differences observed. Aboriginal Canadians living in rural or remote areas are geographically removed and have little access to primary care and necessary specialized services.^{2,35} And although those living in urban areas are closer to health care services, cultural concepts and differences may be barriers to accessing these services.^{36,37}

Our results must be viewed in light of several important limitations. Although the NDSS case definition has been shown to have excellent validity for identifying cases of diagnosed diabetes with 86% sensitivity and 97% specificity – we are likely underestimating the true incidence and prevalence of diabetes.³⁸ This systematic underestimation is likely to be consistent over time, however, so our estimates of the trends should be trustworthy. For example, although data on undiagnosed diabetes are not available in the administrative data, estimates from the United States suggest undiagnosed diabetes rates have remained constant throughout our period of study.³⁹ Another consideration may be a possible gender bias in accessing health care between men and women, although the extent of this difference is not clear. Another potential limitation is that we did not exclude women who may have had gestational diabetes miscoded as diabetes using ICD-9 codes. Therefore, as explained earlier, increased diabetes rates among women may be due in part to gestational diabetes and not Type 2 diabetes. We decided to include these cases due to the elevated risk of these women to subsequently develop diabetes,²⁰ thus allowing to assess that risk on a population basis in the future.

It should also be noted that our definition of Status Aboriginal does not allow generalization to all Aboriginal people in Canada, including First Nations, Metis and Inuit. Status Aboriginal refers to individuals who are registered within the Indian Act (thus identifiable with the Alberta Health and Wellness Registry file), regardless of their tribal membership. Thus, our data would exclude Metis and

any First Nations or Inuit who self-identify but may not be registered. While this is an inherent limitation in our data source, at the same time it allows for generalizability to the similar systems available for surveillance of diabetes in other provinces and territories in Canada.¹⁶

A final limitation that we acknowledge is with respect to identifying location of residence. We stratified our rural and urban residents using the FSA from the Stakeholder registry. Other methods may be used to define urban or rural status, such as based on distance from major centres or population density;³⁰ each method has its advantages and disadvantages, although the different approaches estimate similar proportions of the population, and generally result in the same analytical conclusions.³⁰ We recognize that some potential misclassification may have occurred as people do not always live where they are registered, and furthermore, we did not track changes in registered addresses for individuals over the 10-year follow-up period, so we were unable to adjust for migration between rural and urban residences. Specific data on urban and rural migration are generally lacking for the Aboriginal population; from Canadian Census data, it appears that First Nations who have lived off-reserve had a greater propensity to change communities than the First Nations population who lived on-reserve.⁴⁰

Despite these limitations, the strengths of our analysis, including the population-based data and the length of the follow-up period, provide a strong basis for the observed differences in trends between Status Aboriginal people in urban and rural residences and reveal needed areas of further research into the environmental determinants of diabetes in the Aboriginal population. Further, these data do not allow us to explore the nature of the social and physical environment which may potentially influence outcomes. In particular, we do not know how age, socio-economic status, lifestyle, proximity to urban location, or location within an urban centre influences diabetes prevalence and incidence.

CONCLUSION

We observed significant increases in incidence and prevalence of diabetes among the Status Aboriginal population in Alberta. Diabetes prevalence and incidence were highest in Status Aboriginal women, but these rates have increased faster in men over the past decade, regardless of location of residence. These trends have important implications for targeted prevention and health promotion strategies for the Status Aboriginal Canadians.

REFERENCES

- Young TK. Review of research on aboriginal populations in Canada: Relevance to their health needs. *BMJ* 2003;327:419-22.
- Young TK, Reading J, Elias B, O'Neil JD. Type 2 diabetes mellitus in Canada's First Nations: Status of an epidemic in progress. *CMAJ* 2000;163:561-66.
- Macaulay AC, Cook CL. Type 2 Diabetes in Aboriginal Peoples. Canadian Diabetes Association Clinical Practice Guidelines Expert Committee. 2003 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada. *Can J Diabetes* 2003;27(Suppl 2):S110-S112.
- Harris SB, Gittelsohn J, Hanley A, Barnie A, Wolever TM, Gao J, et al. The prevalence of NIDDM and associated risk factors in native Canadians. *Diabetes Care* 1997;20:185-87.
- Fox C, Harris SB, Whalen-Brough E. Diabetes among Native Canadians in northwestern Ontario: 10 years later. *Chron Dis Can* 1994;15:92-96.
- Xiong W, Gray JD. The roles of receptor abnormalities in the pathogenesis and chronic complications of type 2 diabetes mellitus. *Clin Invest Med* 1999;22:85-106.
- Hanson RL, Imperatore G, Venkat Narayan KM, Roumain J, Fagot-Campagna A, Pettitt DJ, et al. Family and genetic studies of indices of insulin sensitivity and insulin secretion in Pima Indians. *Diabetes/Metabolism Research Reviews* 2001;17:296-303.
- Hegele RA, Cao H, Harris SB, Zinman B, Hanley AJ, Anderson CM. Gender, obesity, hepatic nuclear factor-1 alpha G219S and the age-of-onset of type 2 diabetes in Canadian Oji-Cree. *Int J Obesity & Related Metabolic Disorders* 2000;24:1062-64.
- Hegele RA, Bartlett LC. Genetics, environment and type 2 diabetes in the Oji-Cree population of Northern Ontario. *Can J Diabetes* 2003;27:256-61.
- Williams DE, Knowler WC, Smith CJ, Hanson RL, Roumain J, Saremi A, et al. The effect of Indian or Anglo dietary preference on the incidence of diabetes in Pima Indians. *Diabetes Care* 2001;24:811-16.
- Ravussin E, Valencia ME, Esparza J, Bennett PH, Schulz LO. Effects of a traditional lifestyle on obesity in Pima Indians. *Diabetes Care* 1994;17:1067-74.
- O'Dea K, Spargo RM, Akerman K. The effect of transition from traditional to urban life-style on the insulin secretory response in Australian Aborigines. *Diabetes Care* 1980;3:31-37.
- Szathmari EJ, Ritenbaugh C, Goodby CS. Dietary change and plasma glucose levels in an Amerindian population undergoing cultural transition. *Soc Sci Med* 1987;24:791-804.
- Meisinger C, Thorand B, Schneider A, Stieber J, Doring A, Lowel H. Sex differences in risk factors for incident type 2 diabetes mellitus: The MONICA Augsburg Cohort Study. *Arch Intern Med* 2002;162:82-89.
- Njolstad I, Amesen E, Lund-Larsen PG. Sex differences in risk factors for clinical diabetes mellitus in a general population: A 12-year follow-up of the Finnmark Study. *Am J Epidemiol* 1998;147:49-58.
- NDSS Abridged Methods for the 2000-2001 to 2004-2005 Data. National Diabetes Surveillance System, Public Health Agency of Canada. Available online at: <http://www.phac-aspc.gc.ca/publicat/2008/dicndss-dacsnsd-04-05/index-eng.php> (Accessed October 3, 2008).
- Hemmelgarn BR, Toth EL, King M, Crowshoe L, Ralph-Campbell K. Diabetes and First Nations People in Alberta. In: *Alberta Diabetes Atlas 2007*. Institute of Health Economics, 2007.
- Harris SB, Caulfield LE, Sugamori ME, Whalen EA, Henning B. The epidemiology of diabetes in pregnant Native Canadians. A risk profile. *Diabetes Care* 1997;20:1422-25.
- Dyck R, Klomp H, Tan LK, Turnell RW, Boctor MA. A comparison of rates, risk factors, and outcomes of gestational diabetes between Aboriginal and non-Aboriginal women in the Saskatoon Health District. *Diabetes Care* 2002;25:478-93.
- Feig DS, Zinman B, Wang X, Hux JE. Risk of development of diabetes mellitus after diagnosis of gestational diabetes. *CMAJ* 2008;179:229-34.
- Glazier RH, Booth GL, Gozdyra P, Creatore MI, Tynan M (Eds.). *Neighbourhood Environments and Resources for Healthy Living—A Focus on Diabetes in Toronto: ICES Atlas*. Toronto, ON: Institute for Clinical Evaluative Sciences, 2007.
- French SA, Story M, Jeffery RW. Environmental influences on eating and physical activity. *Annu Rev Public Health* 2001;22:309-35.
- Arcury TA, Snively BM, Bell RA, Smith SL, Stafford JM, Wetmore-Arkader LK, Quandt SA. Physical activity among rural older adults with diabetes. *J Rural Health* 2006;22(2):164-68.
- Booth GL, Hux JE, Fang J, Chan BT. Time trends and geographic disparities in acute complications of diabetes in Ontario, Canada. *Diabetes Care* 2005;28:1045-50.
- Toth EL, Majumdar SM, Lewanczuk RZ, Lee TK, Johnson JA. Compliance with clinical practice guidelines for type 2 diabetes in rural patients: Treatment gaps and opportunities for improvement. *Pharmacotherapy* 2003;23:659-65.
- Pohar SL, Majumdar SR, Johnson JA. Healthcare costs and mortality for Canadian urban and rural patients with diabetes: Population-based trends from 1993-2001. *Clinical Therapeutics* 2007;29:1316-24.
- Jacobs P, Blanchard JF, James RC, Depew N. Excess costs of diabetes in the Aboriginal population of Manitoba, Canada. *Can J Public Health* 2000;91:298-301.
- Pohar SL, Johnson JA. Health care utilization and costs in Saskatchewan's registered Indian population with diabetes. *BMC Health Serv Res* 2007;7:126.
- Government of Canada. Indian Act. Ottawa: The Government of Canada, 1996. Cat. No. YX76-15/1996.
- du Plessis V, Beshiri R, Bollman RD, Clemenson H. Definitions of rural. Rural and Small Town Canada Analysis Bulletin 2001;3(3). Statistics Canada Catalogue no. 21-006-XI.
- Statistics Canada: Age and Sex for Population, for Canada, Provinces, Territories, Census Metropolitan Areas and Census Agglomerations, 2001 Census. [article online], 2007. Catalogue Number: 95F0300XCB2001004.
- Fay MP, Feuer EJ. Confidence intervals for directly standardized rates: A method based on the gamma distribution. *Stat Med* 1997;16:791-801.
- Chase LA. The trend of diabetes in Saskatchewan, 1905-1934. *CMAJ* 1937;36:366-69.
- Martens PJ, Martin BD, O'Neil JD, MacKinnon M. Diabetes and adverse outcomes in a First Nations population: Associations with healthcare access, and socioeconomic and geographical factors. *Can J Diabetes* 2007;31:223-32.
- Shah BR, Gunraj N, Hux JE. Markers of access to and quality of primary care for aboriginal people in Ontario, Canada. *Am J Public Health* 2003;93:798-802.
- Browne AJ, Fiske J. First Nations women's encounters with mainstream health care services. *Western J Nurs Res* 2001;23:126-47.
- Tookenay V. Improving the health status of aboriginal people in Canada: New directions, new responsibilities. *CMAJ* 1996;155:1581-83.

38. Hux JE, Ivis F, Flintoft V, Bica A. Diabetes in Ontario: Determination of prevalence and incidence using a validated administrative data algorithm. *Diabetes Care* 2002;25:512-16.
39. Centers for Disease Control and Prevention: Prevalence of Diabetes and Impaired Fasting Glucose - United States, 1999-2000. *MMWR* 2008;52:833-37.
40. Analysis of Native Migration. The Canadian Encyclopedia. Available online at: <http://www.thecanadianencyclopedia.com/index.cfm?PgNm=TCE&Params=A1SEC824999> (Accessed October 3, 2008).

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RÉSUMÉ

Objectif : Comparer les changements de taux de prévalence et d'incidence du diabète diagnostiqué chez les hommes et les femmes qui appartiennent à la population autochtone et qui résident dans les régions urbaines et rurales de l'Alberta.

Méthodes : Nous avons comparé les tendances des taux de prévalence et d'incidence du diabète de 1995 à 2006, selon les codes de diagnostic des dossiers administratifs conservés par Alberta Health and Wellness (AHW) pour les adultes âgés de 20 ans ou plus. Les fichiers du registre d'AHW ont été utilisés pour déterminer le statut de personne inscrite comme Autochtone, en plus de sa résidence rurale ou urbaine (selon le code postal). Une analyse de régression logistique multidimensionnelle a été utilisée pour comparer les taux de diabète au fil des ans, selon le sexe et le lieu de résidence.

Résultats : Le taux de prévalence du diabète, rajusté pour tenir compte de l'âge et du sexe, a augmenté de 35 % chez les Autochtones qui résident en milieu rural, de 10,9 (10,4 à 11,5) par 100 habitants en 1995 à 14,7 (14,2 à 15,2) par 100 habitants en 2006. Le taux de prévalence du diabète chez les Autochtones qui résident en milieu urbain a augmenté de 22 % au cours de la même période, de 9,4 (8,5 à 10,3) par 100 habitants en 1995 à 11,5 (10,9 à 12,1) par 100 habitants en 2006. Les augmentations des taux de prévalence ($p < 0,001$) chez les hommes (43 % et 40 %) ont été supérieures à celles des femmes (30 % et 12 %) dans les milieux ruraux et urbains, respectivement. Le taux d'incidence du diabète a augmenté de 45 % chez les hommes autochtones, de 7,4 (4,9 à 10,6) par 1000 habitants en 1995 à 10,7 (8,3 à 13,5) par 1000 habitants en 2006 dans les régions urbaines, comparativement à une augmentation de 35 % chez les hommes autochtones des régions rurales ($p = 0,628$). Chez les femmes autochtones, le taux d'incidence a augmenté de 25 % dans les régions urbaines, mais il est demeuré le même dans les régions rurales ($p = 0,109$).

Conclusions : Les taux de prévalence et d'incidence du diabète diagnostiqué étaient plus élevés chez les femmes autochtones, mais ces taux ont augmenté plus rapidement chez les hommes autochtones au cours de la dernière décennie, peu importe le lieu de résidence.

Mots clés : diabète; épidémiologie; santé en milieu rural; personne appartenant à la population autochtone

Coming Events • Activités à venir

CSEB-APHEO 2009 Joint Conference

Expanding Horizons in Epidemiology: From Research into Practice
Canadian Society for Epidemiology and Biostatistics, and Association of Public Health Epidemiologists in Ontario
25-28 May 2009
Ottawa, ON
Contact:
www.cseb-apheo-09.ca

2009 CPHA Annual Conference/ Conférence annuelle de l'ACSP 2009

Public Health in Canada: Strengthening Connections/
La santé publique au Canada : renforcer les liens
7-10 June/juin 2009
Winnipeg, MB
Contact/contacter :
E-mail/courriel : conference@cpha.ca www.cpha.ca

5th International Conference of the International Society for Equity in Health

Social and Societal Influences on Equity in Health
9-11 June 2009
Crete, Greece
Contact:
<http://www.iseqh-conference2009.com/index.php?lang=en>

26th International Congress of Chemotherapy and Infection

Organized by ISC, AMMI and CACMID
18-21 June 2009
Toronto, ON
Contact:
www.icc-09.com

19th World Conference on Disaster Management

A Climate for Change – Communication, Collaboration and Co-operation
Canadian Centre for Emergency Preparedness
21-24 June 2009
Toronto, ON
Contact: Adrian Gordon, CCEP
E-mail: agordon@ccep.ca www.wcdm.org

14th International Congress on Circumpolar Health

Health Canada and the Government of the Northwest Territories
11-16 July 2009
Yellowknife, NT
Contact: Pat Thagard, Congress Coordinator
Arctic Health Research Network
Tel: 867-873-9337
E-mail: icch14@theedge.ca
Fax: 867-873-9338

40th Annual Conference of the Association of Canadian Ergonomists

Ergonomics - Think it. Live it.
14-17 September 2009
Quebec City, QC
Contact:
www.ace-ergocanada.ca

2009 Spirituality and Health Conference: Working Together For Optimal Health

24-26 September 2009
Calgary, AB
Contact:
http://www.ucalgary.ca/~psyc/tree/CPD_Spirituality.pdf

16th Canadian Conference on International Health

Health Equity: Our Global Responsibility
Canadian Society for International Health
25-28 October 2009
Ottawa, ON
Contact: CSIH
Tel: 613-241-5785, ext. 326
E-mail: 2009ccih@csih.org

6th National Conference on Tobacco or Health

What Can We Learn 10 Years Later?
Organized by the Canadian Council for Tobacco Control
1-4 November 2009
Montréal, QC
Contact:
E-mail: conference@cctc.ca www.ncth.ca

Forum 2009

Innovating for the Health of All: Innovation in Systems of Research for Health and Health Equity
Global Forum for Health Research
16-20 November 2009
Havana, Cuba
Contact:
www.globalforumhealth.org/shlinks/forum2009.php

Third International Chronic Disease Conference

Global Perspectives on Chronic Disease: Prevention & Management Conference
2009 – "Above and Beyond"
Alberta Health Services - Calgary
23-26 November 2009
Calgary, AB
Contact:
E-mail: cdm.conference@albertahealthservices.ca
www.cdmcalgary.ca

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