



Article

Diabetes and the Urban Aboriginal Population

2012 UAKN Research Paper Series

Dr. Jeff Reading

Director of the Centre of Aboriginal Health Research and Professor in the School of Public Health and Social Policy at the University of Victoria

The Urban Aboriginal Knowledge Network, the UAKN, is a community driven research network focused on the Urban Aboriginal population in Canada. The UAKN establishes a national, interdisciplinary network involving universities, community, and government partners for research, scholarship and knowledge mobilization. For more information visit: www.uakn.org



National Association
of Friendship Centres
Association nationale
des centres d'amitié



Affaires autochtones et
Développement du Nord Canada

Aboriginal Affairs and
Northern Development Canada

Table of Contents

DIABETES AND THE URBAN AND RURAL ABORIGINAL POPULATION

INTRODUCTION	3
BACKGROUND	3
HEALTH PROMOTION AND HEALTH DETERMINANTS	6
Life course approach	7
METHODS	8
RESULTS	9
Children and Youth	9
Adult	11
Self reported health	11
Description of Diabetic respondents	12
Family Income	12
Health Care Utilization and co-morbidity	13
Access to Care	14
Activity limitations	15
Regional Distribution of Diabetes by Urban Area	16
SUMMARY AND CONCLUSION	18

Introduction

The paper is the sole property of the Urban Aboriginal Knowledge Network. The purpose of the paper is to describe the off reserve findings from the 2006 Aboriginal Peoples Survey (APS) conducted by Statistics Canada which collected data on the lifestyles and living conditions of Aboriginal peoples living in Canada. The paper is organized to familiarize the reader with diabetes and the precursors and co-morbid conditions together in a brief review of published literature, followed by a description of health promotion, health determinants and the life course framework for analysis.

Background

The World Health Organization calculates the chronic disease and conditions to account for some 60% of all deaths worldwide in 2005 (WHO 2005). In Canada it is no secret that preventable disease, disability and premature death among Aboriginal populations¹ are great and growing concerns. Among the causes of morbidity and mortality, communicable disease threats have increased in importance, along with external causes and chronic diseases which have become a major health problem (Smeja and Brassard 2000; Waldram, Herring and Young 2006; Young 1998; Kmetc, Reading et al 2008) contributing to a grave public health situation (Waldram, Herring and Young 2006; Postl, Moffatt and Sarsfield 1987; Webster 2005).

Numerous studies demonstrate that the Aboriginal population in Canada bears a disproportionately higher burden of some chronic illnesses, especially diabetes, than do non-Aboriginal Canadians (First Nations and Inuit Regional Health Survey National Steering Committee / FNIRHSNSC 1999, 2003; Frolich, Ross et al 2006; Ayach and Korda 2010; Oster and Toth 2009; Ralph-Campbell, Oster et al. 2009). International research on indigenous health also demonstrates higher rates of diabetes and its risk factors among indigenous peoples versus the rest of the population (Su, Hwang et al 2009; Bramley, Hebert et al 2004; Holm, Vogeltanz-Holm et al 2010; Uauy, Albala et al 2001; Narva 2010).

¹ Aboriginal (First Nation, Inuit and Métis) are all terms recognized in the Constitution Act of Canada 1982, Section 35, 2 and are used in this paper to describe the Indigenous Peoples of Canada and their descendants. The unique historic, political and economic complexities incorporate multiple constructions of health and distinct cultural values. That historical circumstances have shaped the health and well-being of Aboriginal populations is acknowledged and understood. All three Aboriginal groups have undergone a process of colonization, which included the dispossession of ancestral lands, the imposition of colonial institutions and the disruption of traditional lifestyles. This paper respectfully acknowledges that historical, political and social inequities have shaped the present health of Aboriginal communities.

In Canada, chronic diseases among the Aboriginal population represents a growing crisis that needs urgent attention, given that almost one-third of Aboriginal peoples in Canada over 15 years report that they have been told by a health practitioner that they have a chronic health condition (FNIRHSNSC 1999, 2003; MacMillan et al 1996). Although historically undetected in Canada's Aboriginal populations, recent evidence reveals that diabetes in First Nations communities has reached epidemic proportions (AFN 2005). The epidemiologic trajectory is overwhelming; according to the 1991 Aboriginal Peoples Survey, the crude prevalence for diabetes in First Nations people was 6.4% and 8.5% for living on and off reserve respectively (Bobet 1998). In contrast, the 2002/2003 Regional Health Survey (RHS) reported an age standardized prevalence of 19.7% for First Nations peoples, indicating a substantial increase since 1991 (First Nations Information Governance Committee / FNIGC 2005). What is clear is this is a significantly higher prevalence of diabetes than the national average, which was reported to be 3.1% in 1991 (Bobet 1998) and 4.5% in 2002/2003 (FNIGC 2005). The RHS from 2008/10 shows a rate of 20.7%, continuing the upward trend (FNIGC 2011).

The early onset of diabetes in Aboriginal populations is another troubling aspect of this disease burden. Notwithstanding the risks posed by childhood obesity among urban Aboriginal children and youth (Ng, Young and Corey 2010) and pre-diabetic impaired glucose tolerance, and although Type 2 diabetes has not been traditionally observed in youth, the data demonstrate that the incidence of diabetes among children and youth is changing rapidly (Laboratory Centre for Disease Control 2000). Although caregivers reported their children's health as very good, 42.4% of children had been diagnosed with a chronic condition, with boys having higher rates than girls (FNIGC 2011). RHS data also noted that the number of overweight or obese First Nations children in Canada increased to 62.3% (FNIGC 2011), indicating a risk for even higher rates of diabetes in the future. In addition to concerns about its prevalence and increasing incidence rates, diabetes is associated with many severe complications and conditions that are connected to other chronic diseases, thus adding a cumulative risk to health and well-being (Young, Reading et al 2000).

Among First Nations adults with type 2 diabetes, over 66% also had hypertension, 55% had arthritis and 25-30% also suffered from heart disease, hearing troubles, cataracts, and allergies (FNIGC 2011). The systemic physiological consequences are distressing given that multiple co-morbidities that many older Aboriginal people experience affect the circulatory system, eyes, kidneys, periodontal and nervous systems, and is likely to accelerate disease trajectories, resulting result in premature mortality, preventable disability, and a severely compromised quality of life. Having multiple conditions puts individuals at much greater health risk especially if they smoke or are overweight or obese.

The diabetes crisis among indigenous peoples is increasingly a global concern affecting health care delivery systems. Finding solutions to the recalcitrant problems posed by diabetes and even being able to conceptualize the origin of problems constitute an opportunity for international collaboration and exchange. Research in Canada, New Zealand and the US has noted that indigenous people are

more likely than non-indigenous people to have greater health risks, yet at the same time have a lower use of prevention and specialized services, and poorer management of their diabetes (Narva and Sequist 2010; Tomlin, Tilyard, et al 2006; Yeates, and Tonelli 2010).

Reviews have noted that there is inadequate intervention research to provide an evidence base for cardiovascular and metabolic health among indigenous peoples throughout the world, and that services vary considerably (Mau, Sinclair et al 2009; Daniel, McNamara Sanson-Fisher, et al 2010; Sun 2011). At the same time, health care services that provide high-quality, culturally sensitive, interdisciplinary care offer positive examples of service delivery in Aboriginal communities (Maar, Gzik, et al 2010; Oster, Shade, et al. 2010; Tobe, Vincent, et al 2010).

An emerging theme of research in Canada and abroad is that the health of indigenous peoples needs to be conceptualized as embedded within social contexts; therefore community level strengths and challenges must be included in the analysis of individuals' health issues, including chronic diseases such as diabetes (Iwasaki, Bartlett et al 2007). Research has also noted that the environmental and social contexts have significant impacts on health status and that social contexts create common experiences among indigenous peoples, challenging the notions of biological determinism which postulate the genetic predisposition as primary predictor of diabetes (Lai, Tucker et al 2009; Fee 2006). A study investigating native Hawaiians with diabetes noted that emotional and social support were important predictors of health behaviours, and that native Hawaiians were better served when healthcare providers understood the social contexts of emotional support (Shahan 2010).

In a research project to identify the sociodemographic, environmental, and lifestyle factors associated with the geographic variability of diabetes prevalence in the City of Winnipeg, Manitoba; high rates of diabetes prevalence were strongly correlated with indicators of low socioeconomic status, poor environmental quality and poor lifestyles (Green, et al, 2003).

Health research with Aboriginal peoples has demonstrated differences between men and women, both physically and socially. The 2008/10 RHS data, based on sampling of Canada's First Nations populations, showed that First Nations women have higher rates of diabetes than men across all age categories, with close to half of First Nations women over 65 having diabetes (FNIGC 2011). This is an opposite pattern to the general population where diabetes is more prevalent among men. Gender differences show other patterns both intuitive and counter-intuitive. A study in the US investigating diabetes with Native Americans and another study with Canadian Aboriginal peoples found that women with diabetes had a higher percentage of body fat than women without diabetes, (Chateau-Degat, Pereg et al 2009; Edwards, Pryor et al 2000), whereas the US study also noted that diabetic men had lower body fat than non-diabetic men. Women also experience maternal gestational diabetes, which places Aboriginal women in Canada are at higher risk for adverse pregnancy outcomes including complications during delivery and high infant birthweight (Dyck, Cascagnette, et al, 2010; Shah, Zao et al 2011).

The RHS from 2008/10 noted that male youth are less likely to access health services than females. A U.S. based qualitative study concerned with the psychological consequences of diabetes among men demonstrated that Native American men feared the diagnosis of diabetes; the research showed that they had a fatalistic attitude that once diagnosed with diabetes, their health would spiral downwards until they died from the illness (Cavanaugh, Taylor et al 2008). The RHS 2008/10 data shows that First Nations women accessed more health screening services than men, while at the same time women were more likely to report service access barriers (FNIGC 2011). Research in Australia and Canada has demonstrated that youth and women have higher diabetes risk factors (Ralph- Campbell, Pohar, et al 2006; Li, Campbell et al 2010; Dyck, Osgood, et al 2010). Understanding that age, sex and gender differences exist in both health status and health service use is critical but perhaps as important as physical differences between men and women, social differences need to be considered in program design.

With diabetes trajectories developing earlier in the life course and at higher rates in Aboriginal populations, the impact of diabetes on the health of Aboriginal people and future generations is worrisome and an area in need of more effective health promotion strategies, disease interventions, and culturally-relevant programs. Exploring a gender and life course perspective involves improving maternal, infant, childhood and adolescent health through timed interventions to optimize developmental trajectories. For example, lowering rates of maternal obesity and smoking reduces risk for childhood obesity and inactivity, and adolescent smoking. Successful program interventions are needed to greatly improve adult health by decreasing the incidence and prevalence rates of Type 2 diabetes and its complications. Therefore it is clear that there is a critical global need to develop better diabetes prevention and care for indigenous peoples both in Canada and internationally that examines specific social and local contexts as well as differences among age groups and gender. Rich, locally relevant data tracking patterns of adverse health impacts and their responsiveness to community-driven programming will be necessary to guide Aboriginal health policy. Not only will such data sharpen the argument for improved health and social change throughout the life course, but also to provide innovative insight into strategic prevention-based policy that is needed to alleviate the burden of ill-health and chronic disease within indigenous and mainstream populations. Geographically and culturally focused research will provide the evidence base needed to make this possible.

Health Promotion and Health Determinants

Health promotion activities such as recreational programs, improving nutrition through education, and providing healthy meals through community kitchens are urgently needed and may be a focus for the network of Native Friendship Centres in Canada. Programs for youth include sporting activities, school based nutrition education and meal programs, community gardens, and connecting youth and elders to share knowledge on health. In addition, there are clinical services such as blood sugar and pressure screening, and community based foot and eye clinics. The

community based programs also aim to enhance the coordination of diabetes care through linking community members with other health services, including mobile diabetes clinics.

A need exists to examine how programs contribute to improving population health, biomedical, clinical and health services by emphasizing a holistic life-course approach embedded within a social determinants framework. A useful system of disease surveillance would examine both the delivery processes and their connection to health outcome trajectories over time through an analysis of patient health records and survey data, in addition to community based measures of success. This broad-based approach explores the relative importance and synergy of how the health care system and diverse community factors contribute to the success of intervention programs. Innovative programs offer a complementary evaluation of a major diabetes and chronic condition health and wellness program that examines impacts by comparing linked health databases, as well as examining processes of service delivery, focusing on coordination of care across services.

In addition to the health status data, it is critical to consider policies and governance in health services; health service delivery models; cultural, social, political and economic contexts; community participation; life course; sex and gender; and location. Questions frame the exploration of these themes include:

1. What issues and challenges, including barriers and opportunities, need to be addressed and promoted to improve use and sustainability of diabetes programs?
2. How can programs more effectively reach and engage people and meet their needs? How do programs reach people that are reluctant to engage with services?
3. What local indigenous principles, practices and community strengths shape programs as well as how success is measured?
4. What strategies successfully support diabetes and chronic disease management specific to an urban and rural Aboriginal context that improves health and well-being throughout the life course and for specific age groups?
5. What evidence do the above questions provide for innovative, successful practices in diabetes care?
6. What are the specific gender and sex based issues informing optimal care delivery?
7. How do health determinants, historical trauma and mental health affect diabetes prevention, treatment and care?
8. Are diabetes care providers competent in facilitating coordination of care with other providers?

Life course approach

The life course approach to chronic disease epidemiology is generally understood as a means to study the long-term effects of physical, social, psychological, and behavioural pathways, operating across an individual's life, a community's generations, and a population's development, on chronic disease risk (Ben-Shlomo and Kuh 2002). Danton-Hill describes a life course perspective as allowing "one to

see health differences among populations, social classes, etc. as resulting from an accumulation of material disadvantages [and] that reflect widely differing economic and social life circumstances”. Only after thinking of disease as an aspect of an individual’s life course, can “the prevention and control of chronic diseases...be intimately integrated into normal daily life”, and sustained to benefit the health of communities. Thus, strategies that address risk factors must continually account for “the underlying economic, gender, political, behavioural and environmental factors that foster these disease risks” (Darnton-Hill, et al., 2004) within all age groups and across generations.

As the literature above noted, there are a variety of contextual matters as well as age, sex and gender specific concerns that shape the health of Aboriginal peoples. Life course epidemiology offers a way to conceptualize how underlying biological and socio-environmental determinants of health, experienced at different life course stages, can differentially influence the development of chronic diseases, as they are mediated through proximal specific biological processes (Moore and Davies 2005). Approaching Aboriginal health research through a life course perspective is promising because it provides researchers with the tools to integrate scientific, cultural, and sociological knowledge in meaningful ways; this fusion is necessary to satisfy both the scientific and cultural requirements of Aboriginal health research. Life course research is well- suited to Aboriginal studies because it attempts to understand health in a way that takes into account the deeply rooted social disparities which have been present for generations and is consistent with Aboriginal concepts of wellbeing encompassing the physical, mental, emotional, and spiritual (Kmetz and Reading 2008; Lynch and Smith 2005; Adelson 2005; Bartlett 1998).

Methods

The 2006 Aboriginal Peoples Survey (APS) was a post-census survey, which means that the APS sample was selected from reported answers to the Census questionnaire. The APS was conducted by Statistics Canada to collect data on the lifestyles and living conditions of Aboriginal peoples in Canada. For a detailed review of methods please refer to the Aboriginal Peoples Survey, 2006: Concepts and Methods Guide available on the internet.²

Briefly, the primary objective of the 2006 APS is to provide data on the social and economic conditions of Aboriginal people in Canada. More specifically, it focuses on issues such as health, language, employment, income, schooling, housing, and mobility. The Aboriginal Peoples Survey collects a wide variety of data on the lifestyles and living conditions of Aboriginal people across Canada. Two APS questionnaires were used for this report, namely, the Adult Core (people aged 15 and older); Children and Youth (people aged 6 to 14).

² <http://www.statcan.gc.ca/pub/89-637-x/89-637-x2008003-eng.htm>

The target population for the 2006 APS is composed of the Aboriginal population in Canada living in private dwellings, 6 years of age and older as of October 31, 2006, excluding people living in Indian Settlements or on reserve. Data capture was carried out at the head office in Ottawa. The first stage of error detection was done during the data collection. The second stage of survey processing involved editing all the survey records according to pre-specified edit rules to check for errors, gaps and inconsistencies in the survey data and a macro-level verification was done by analyzing frequency distributions to identify anomalies (for example, missing categories or unusually large frequencies).

Weighting. In the surveys a weight is associated with each selected person to indicate the number of persons that he / she represents. Respondents were stratified and adjusted to reflect a representative sample. A second post-stratification was carried out. This guaranteed that the total Aboriginal population (identity or ancestry), as estimated from the APS filter questions, matched those from the Census filter questions. This post-stratification was done by geographical domain and by age group.

The author did not have access to individual data. All data requests were prepared by Statistics Canada and presented as grouped data in tables.

Results

Children and Youth

Parents (caregivers) were asked to report for Aboriginal children 6-14 yrs. Approximately one in five children with diabetes self-reported health was rated as very good or excellent compared to compared to four out of five children without diabetes.

Of all cases of childhood diabetes almost half were concentrated in very low income families with total annual family income less than \$25,000. Families without childhood diabetes were less likely to be represented in the less than \$25,000 family income cutoff.

Parents reported a 6.5 fold higher diagnosis by a doctor, nurse or health professional for 'psychological or nervous difficulty', (24.7% vs 3.8%). Visits to medical specialists, nurses, general practitioner physicians and pediatricians were higher for children with diabetes compared to those without. Access to physicians was higher for boys (82.5%) compared to girls (74.2%). Children with diabetes were more than seven times more likely to have spent a night in hospital in the 12 months preceding the survey. Less than half of the diabetic children were reported to be taking medication for diabetes (46.8%).

Urban areas had a five fold higher share of Aboriginal children with diabetes compared to rural locations, which could be partially explained by the greater concentration of Aboriginal families living in urban communities. Children were four times more likely to experience activity limitations at home, school and at leisure.

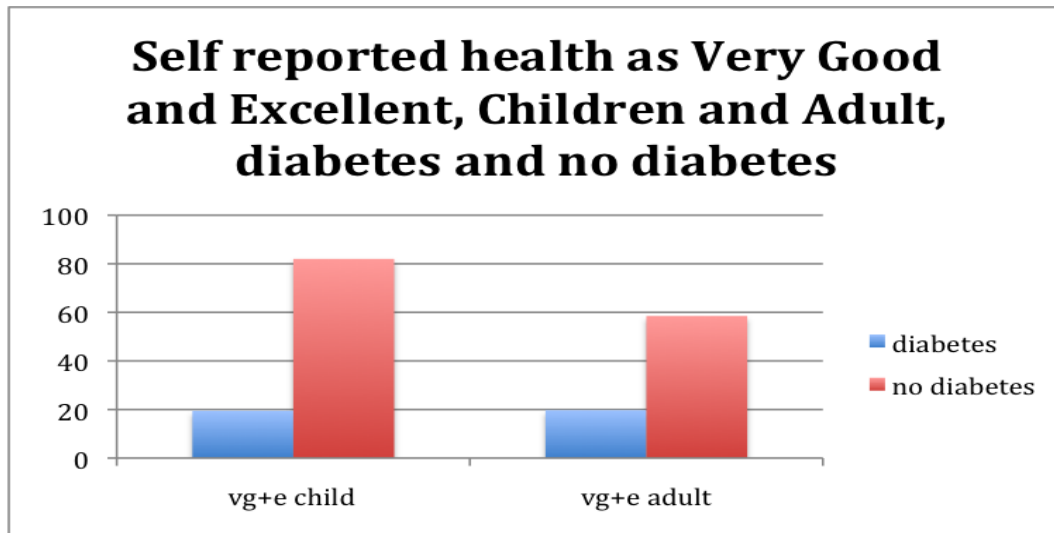
Table 1: Child Health (Census, APS, 2006)

Category	Indicator	With diabetes (%)	Without diabetes (%)
Self reported Health	Excellent	0	57.6
	Very Good	19.5	24.4
	Ex + VG	19.5	82
Family total income	<\$25,000	45.5	25.5
Co-morbidity diagnosed by a doctor, nurse or health professional.	Psychological or nervous difficulty	24.7	3.8
Health Services	Medical specialist	48.1	31
	Nurse	36.4	20.7
	Physician General Practitioner or Pediatrician	79.2	53.8
	Physician for Boy	82.5	55.8
	Physician for Girl	74.2	51.6
	Hospital Stay	Host overnight last 12 months	19.5
Child takes D-meds		46.8	0
Body Composition (CDC method)	Normal weight	32.5	43.9
	Overweight	27.3	21.8
Location	Urban	83.1	68.8
	Rural	16.9	26.2
Activity Limitation	at Home	20.8	5.1
	at School	28.6	8.6
	Leisure/Transportation	18.2	4.6
Region (#Cases)	Ontario (1)	22.1	
	Alberta (2)	17.2	
	British Columbia (3)	16.7	
	Manitoba (4)	13.1	
	Saskatchewan (5)	11.6	

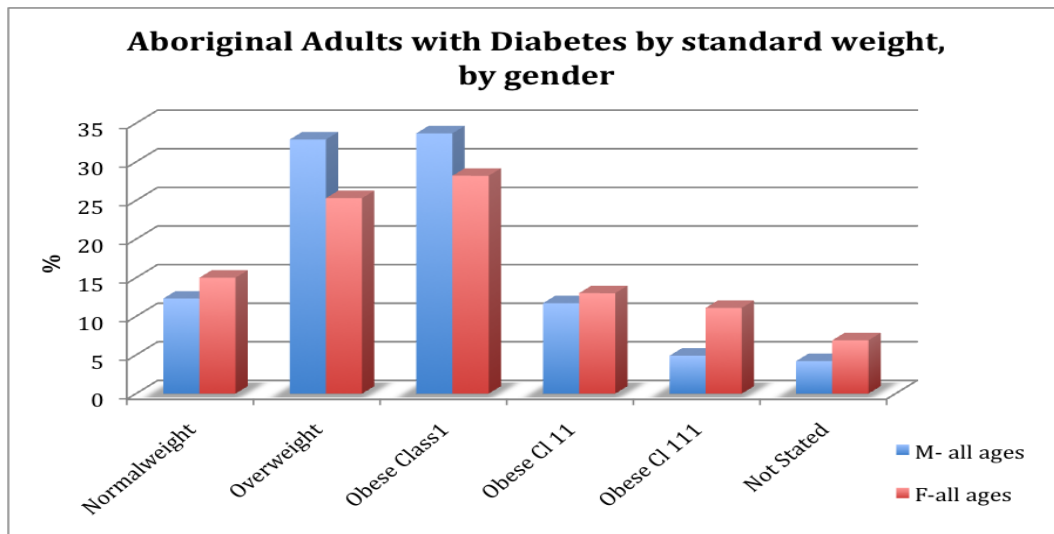
Adult

A strikingly similar pattern to diabetic children was observed for diabetic adults with one in five Aboriginal adults with diabetes self reporting that their health was rated as very good or excellent compared to three out of five Aboriginal adults without diabetes.

Self reported health



Description of Diabetic respondents

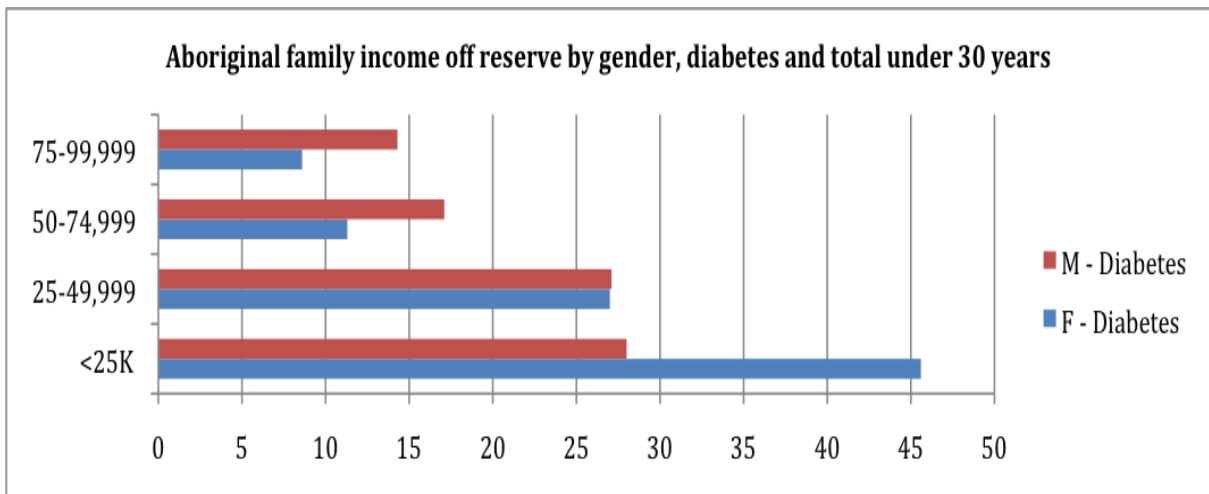
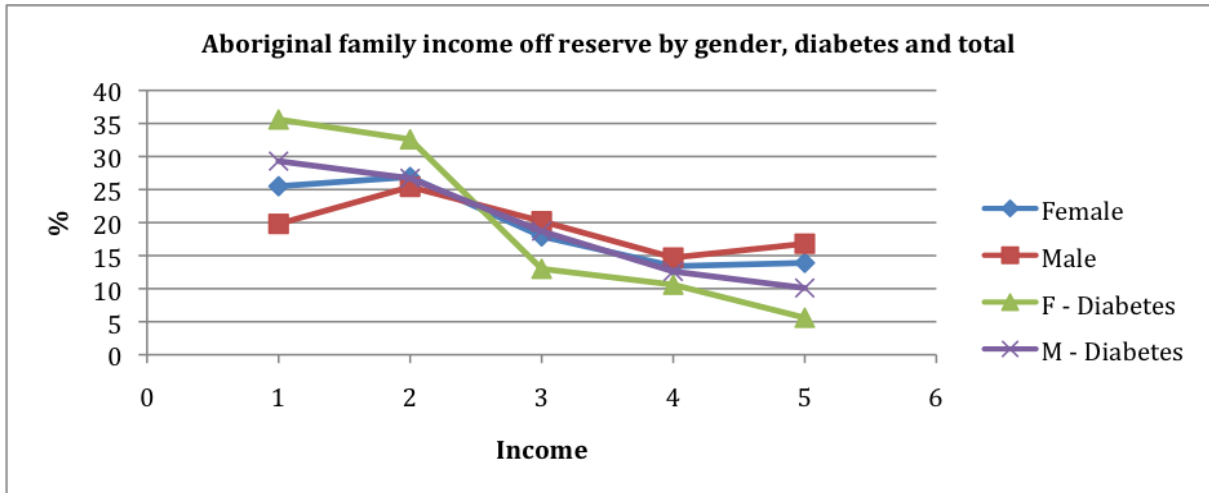


As family income increased the number of cases of diabetes decreased. The pattern showed a negative gradient meaning that diabetes rates increased as incomes decreased from high to low income levels, from greater than \$75,000 per year to less than \$25,000 annually. When the data was sorted by gender, some 50% of female diabetes cases were concentrated in total annual family income less than \$25,000 while for women with greater than \$75,000 less than 10% had diabetes. In a gender comparison, Aboriginal men at higher family incomes were more likely than women to have diabetes whereas women were more likely to experience diabetes at lower levels of income especially at the lowest income level.

Family Income

Aboriginal Family Income - Household Income Categories:

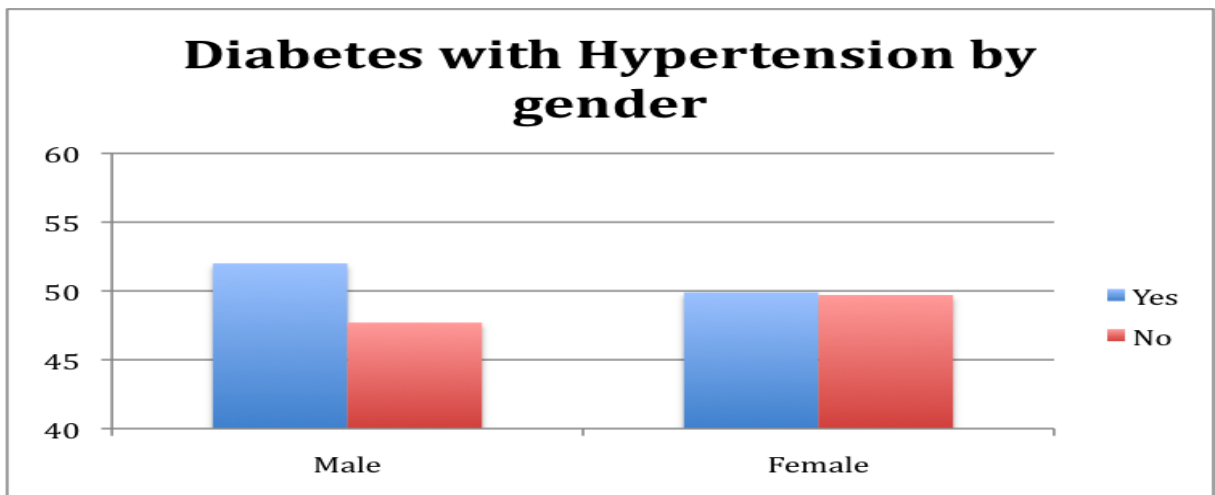
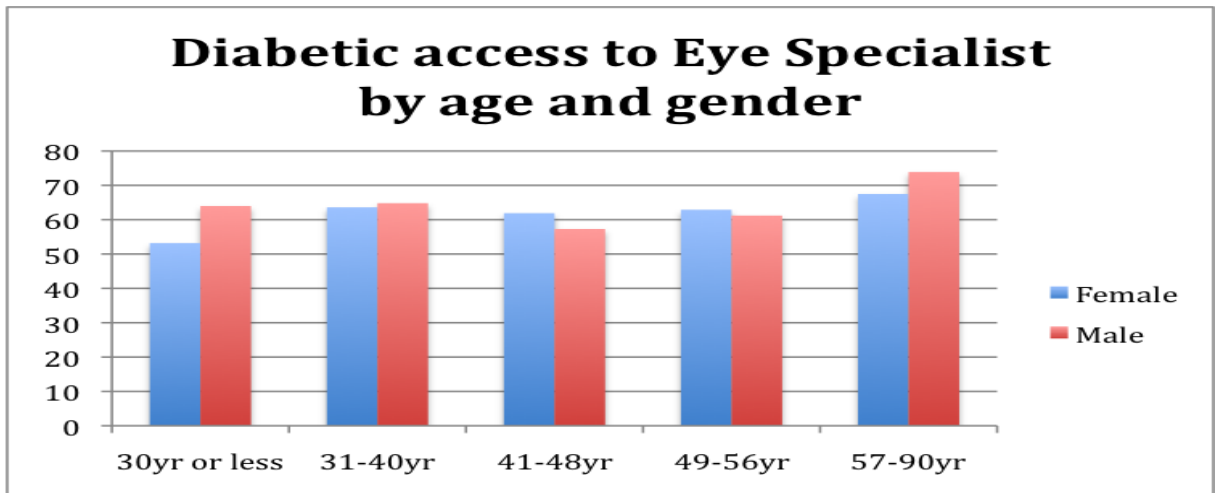
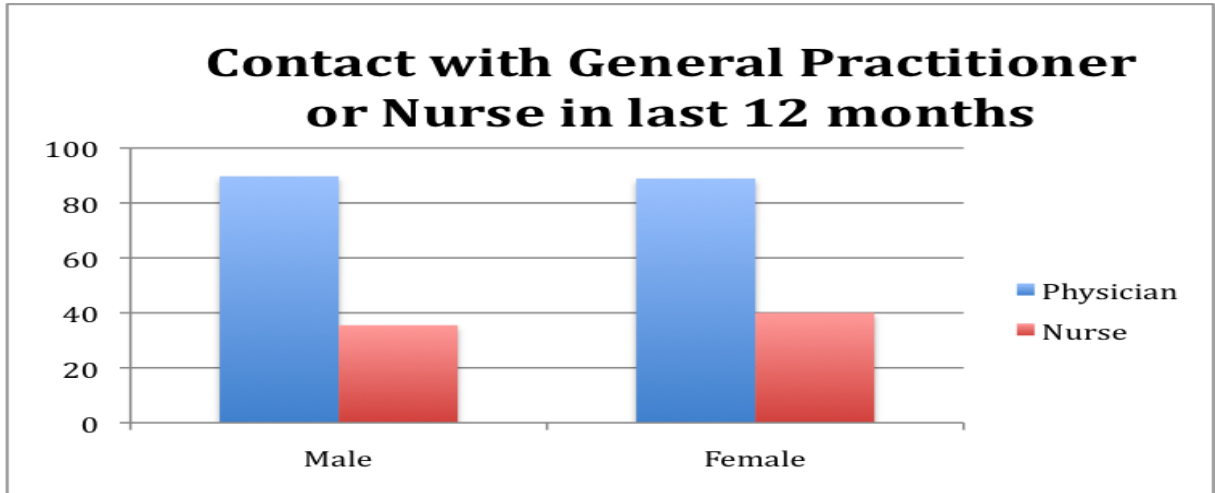
- 1- >\$100,000
- 2- \$75,000 - 99,999
- 3- \$50,000 - 74,999
- 4- \$25,000 - 49,999
- 5- <\$25,000



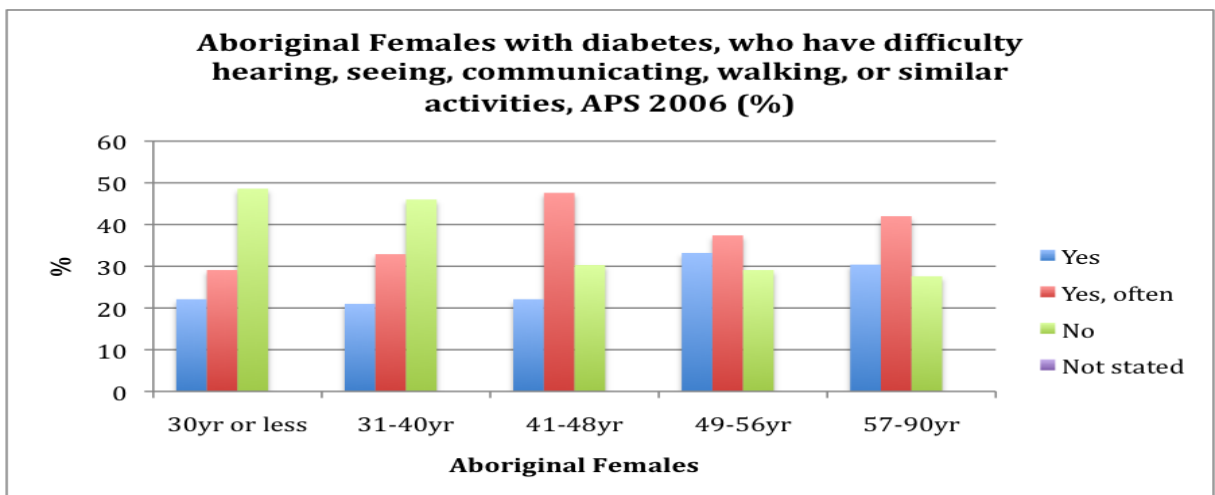
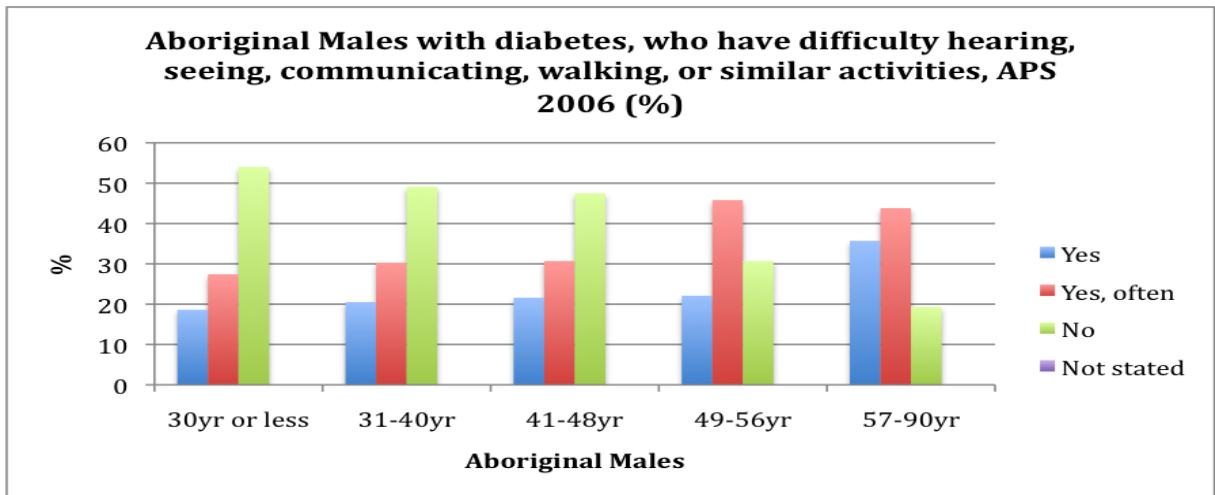
Health Care Utilization and co-morbidity

Adults reported profoundly higher health care utilization rates than non-diabetic Aboriginal people. Eye care specialists were 2 times as high and higher rates of access were observed for nurse consultations, general practitioners and utilization of traditional healers was twice the rate for diabetics (10.8 versus 5.8 for non-diabetic Aboriginal adults). Only one quarter (25%) of diabetic respondents reported taking insulin. The rates of co-morbidity was disturbingly high for conditions including kidney function affected by diabetes (7.3%), heart conditions (23.4%), treatment for heart condition (81.8), circulation (33%), neuropathy (40.9%), lower limbs (29.9%), infection (15.7%), amputation (1.9%), high blood pressure (50.8) and taking treatment for high blood pressure (88%). Rates of tobacco use were similar for diabetic versus non-diabetic Aboriginal adults (31% versus 34%). However activity limitations were twice the rate for Aboriginal people with diabetes.

Access to Care (%)



Activity limitations



Regional Distribution of Diabetes by Urban Area

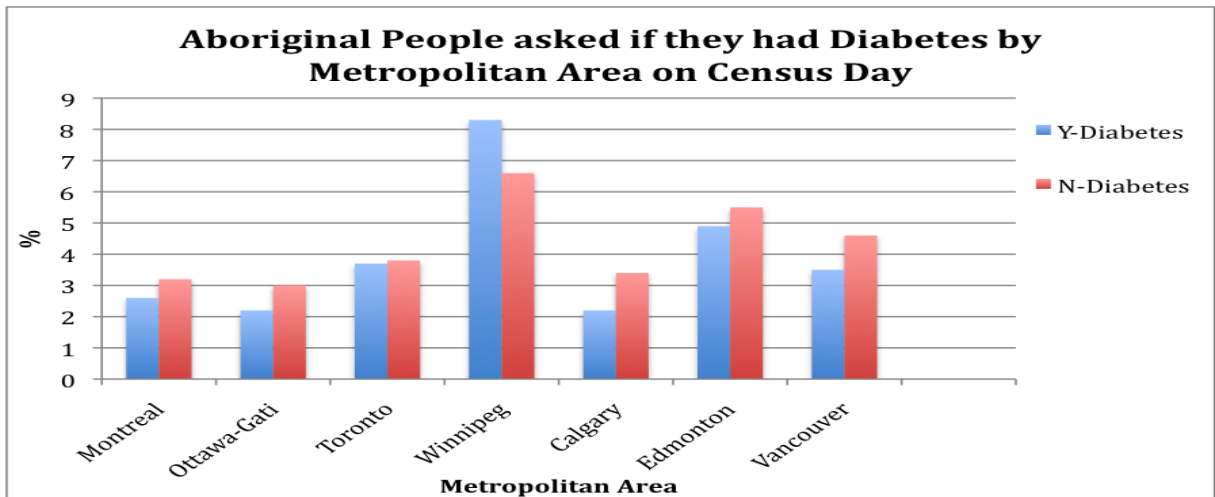
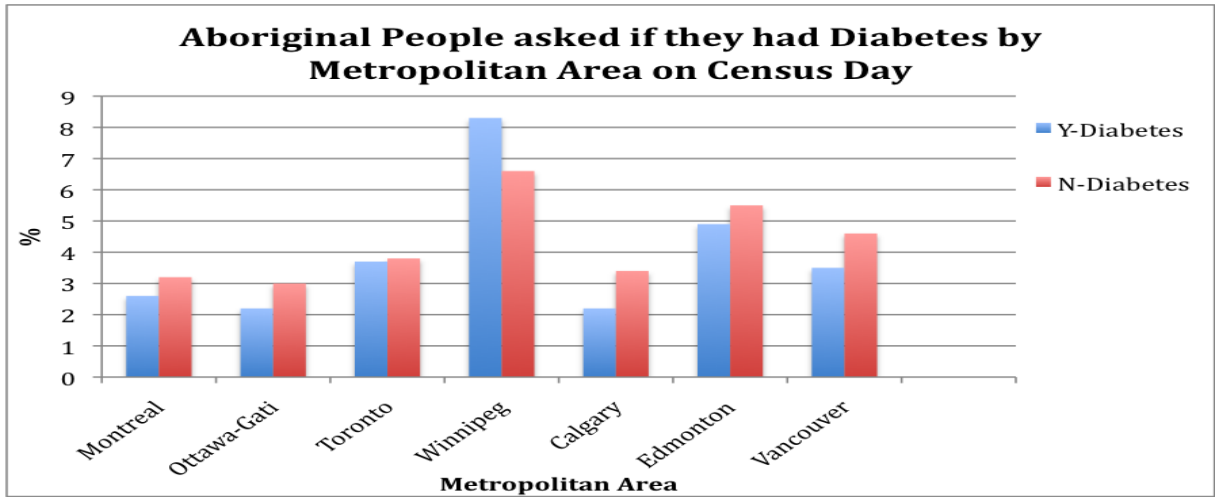


Table 2: Adult Health (Census, APS, 2006)

Category	Indicator	With diabetes (%)	Without diabetes (%)
Self-reported Health	Excellent	4.9	23.8
	Very Good	14.8	34.7
	Ex + VG	19.7	58.5
Diagnosed by a doctor, nurse or health professional.	Diabetes	4.7	94.5
Health Services in last 12 months	Medical specialist – eye	62.2	37.3
	Traditional Healer	10.8	5.8
	Nurse	38	29.3
	Physician General Practitioner	89.2	68.6
Taking insulin		25.2	0
Co-morbidity	Kidney Function affected by diabetes	7.3	1.4
	Heart	23.4	5.7
	Treatment for Heart	81.8	53.3
	Circulation	33	0
	Neuropathy	40.9	0
	Lower limbs	29.9	0
	Infection	15.7	0
	Amputation	1.9	0
	High Blood Pressure	50.8	13
	Take treatment for BP	88	65.8
Tobacco	Daily	31	34
	Occasional	8.6	9.3
Activity Limitation	Yes	25.3	15.3
	Yes, often	36.7	14.9
	Sum Yes + Yes, often	62	30.2

Summary and Conclusion

Diabetes is recognized as a major health concern for Aboriginal people living in urban and rural communities in Canada. It is important to investigate the burden of diabetes among Aboriginal people living in mainstream urban and rural communities.

The 2006 Aboriginal Peoples Survey conducted by Statistics Canada, has shown that diabetes is an important health problem for off reserve Aboriginal people. Diabetes is associated with the growing challenge of obesity among Aboriginal children; it is also connected to upstream health determinants including household poverty, poor self perception of health and well being, challenges for access to preventative services, medical treatment, and care/rehabilitation.

Clearly, diabetes is connected to a plethora of chronic conditions where the end game is vascular disease and heart disease. It is critical that a life course approach is employed to optimize developmental trajectories that promote health across the lifespan at each stage from pre-conception health of the mother to the intra-uterine environment, post-natal period, infant, child, youth, adult and Elder life stages.

Interventions need to be grounded in the circumstances of disparities in social and economic determinants of health to mitigate the corrosive effects of poverty on healthy growth and development. Gender specific interventions need to be tailored to ensure equal opportunity and access to programs and services for all.

The National Association of Friendship Centres is well positioned to play a role in improving health and wellness by creating new programs that are designed with, for and by Aboriginal people to promote self-determination through healthy living. This could be accomplished through new community based Aboriginal focused health centres and medical clinics, which could serve a catalytic role in addressing the problems associated with diabetes and other chronic conditions mentioned in this paper.

References

- Adelson, N., (2005) The embodiment of inequity: health disparities in Aboriginal Canada. *Canadian journal of public health. Revue canadienne de sante publique*, 96 Suppl 2: p. S45.
- AFN (2005) First Nations health research and information action plan., AFN, Editor.
- Ayach, B. B. and H. Korda (2010) "Commentary: Type 2 Diabetes Epidemic in First Nations People of Canada." *Ethnicity & Disease* 20(3): 300-303.
- Bartlett, J. G., Y. Iwasaki, et al. (2007). "Framework for Aboriginal-guided decolonizing research involving Metis and First Nations persons with diabetes." no. 11(pp. 2371-2382).
- Bartlett, J., (1998) *The Medicine Wheel for comprehensive development in health*, University of Manitoba, Winnipeg.
- Ben-Shlomo, Y. and D. Kuh, (2002) A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdisciplinary perspectives. *Int J Epid*, 31(2): p. 285-93.
- Bobet, E. (1998). *Diabetes among First Nations people: information from the Statistics Canada 1991 Aboriginal Peoples Survey*. Health Canada and Statistics Canada. Ottawa, Health Canada.
- Bramley, D., P. Hebert, et al. (2004). "Indigenous disparities in disease-specific mortality, a cross-country comparison: New Zealand, Australia, Canada, and the United States." *New Zealand Medical Journal* 117(1207): U1215.
- Cavanaugh, C. L., C. A. Taylor, et al. (2008). "Cultural perceptions of health and diabetes among Native American men." *Journal of Health Care for the Poor & Underserved* 19(4): 1029-1043.
- Chateau-Degat, M. L., D. Pereg, et al. (2009). "Diabetes and Related Metabolic Conditions in an Aboriginal Cree Community of Quebec, Canada." *Canadian Journal of Diabetes* 33(3): 156-162.
- Dyck, R. F., N. D. Osgood, et al. (2010). "End Stage Renal Disease Among People with Diabetes: A Comparison of First Nations People and Other Saskatchewan Residents from 1981 to 2005." *Canadian Journal of Diabetes* 34(4): 324-333.
- Dyck, R. F., P. J. Cascagnette, et al. (2010). "The Importance of Older Maternal Age and Other Birth-Related Factors as Predictors for Diabetes in Offspring: Particular Implications for First Nations Women?" *Canadian Journal of Diabetes* 34(1): 41-49.
- Edwards, K. A., S. Pryor, et al. (2000). "Calorie use and obesity among diabetic and non-diabetic Mvskoke Indians." *Journal of Cultural Diversity* 7(2): 36-40.
- Fee, M. (2006). "Racializing narratives: obesity, diabetes and the "Aboriginal" thrifty genotype." *Social Science & Medicine* 62(12): 2988-2997.

First Nations and Inuit Regional Health Survey National Steering Committee (2003). First Nations Regional Longitudinal Health Survey, in RHS 2002/2003. Ottawa: First Nations and Inuit RHS National Steering Committee.

First Nations and Inuit Regional Health Survey National Steering Committee (1999) First Nations and Inuit regional health survey. Ottawa: First Nations and Inuit Regional Health Survey National Steering Committee.

First Nations Information Governance Committee (2005), First Nations Regional Health Survey (2002/03). Ottawa: FNIGC.

First Nations Information Governance Committee (2011), First Nations Regional Health Survey, Phase 2 (2008/10) Preliminary Results. Ottawa: FNIGC.

Frohlich, K. L., N. Ross, et al. (2006). "Health disparities in Canada today: some evidence and a theoretical framework." *Health Policy* 79(2-3): 132-143.

Green C.; Hoppa R.D.; Young T.K.; Blanchard J.F. (2003) Geographic analysis of diabetes prevalence in an urban area. *Social Science and Medicine*, Volume 57, Number 3, August 2003 , pp. 551-560(10)

Holm, J. E., N. Vogeltanz-Holm, et al. (2010). "Assessing health status, behavioral risks, and health disparities in American Indians living on the northern plains of the U.S." *Public Health Reports* 125(1): 68-78.

Iwasaki, Y., J. Bartlett, et al. (2005). "Coping with stress among Aboriginal women and men with diabetes in Winnipeg, Canada." *Social Science & Medicine* 60(5): 977-988.

Kmetic, A., J. Reading, et al. (2008). "Taking a life course perspective on cardiovascular disease and diabetes in First Nations peoples." *Canadian Journal of Nursing Research* 40(3): 58-78.

Laboratory Centre for Disease Control. Diabetes, D. (2000). Diabetes in Canada, national statistics and opportunities for improved surveillance, prevention and control. Ottawa, Health Canada, Health Protection Branch, Laboratory Centre for Disease Control, Bureau of Cardio-Respiratory Diseases & Diabetes, Diabetes Division: 70, xiii, 76.

Lai, C.-Q., K. L. Tucker, et al. (2009). "Population admixture associated with disease prevalence in the Boston Puerto Rican health study." *Human Genetics* 125(2): 199-209.

Li, M., S. Campbell, et al. (2010). "Six year weight change and type 2 diabetes among Australian Indigenous adults." *Diabetes Research & Clinical Practice* 88(2): 203-208.

Lynch, J. and G.D. Smith, (2005) A life course approach to chronic disease epidemiology. *Annu Rev Public Health*, 26: p. 1-35.

Maar, M., D. Gzik, et al. (2010) "Beyond Expectations: Why Do Aboriginal and Euro-Canadian Patients with Type 2 Diabetes on a Northern, Rural Island Demonstrate Better Outcomes for Glycemic, Blood Pressure and Lipid Management than Comparison Populations?" *Canadian Journal of Diabetes* 34(2): 127-135.

- MacMillan, H.L., et al., (1996) Aboriginal health. *Canadian Medical Association Journal*, 155(11): p. 1569-78.
- Mau, M. K., K. Sinclair, et al. (2009). "Cardiometabolic health disparities in native hawaiians and other pacific islanders." *Epidemiologic Reviews* 31(1): 113-129.
- McNamara, B. J., R. Sanson-Fisher, et al. (2011). "Type 2 diabetes in Indigenous populations: Quality of intervention research over 20 years." *Preventive Medicine* 52(1): 3-9.
- Moore, V.M. and M.J. Davies, (2005) .Diet during pregnancy, neonatal outcomes and later health. *Reprod Fertil Dev*, 17(3): p. 341. NAHO, First Nations Regional Longitudinal Health Survey (RHS) 2002/2003., in RHS, F.N.a.I.R.H.S.N.S. Committee, Editor. 2005, National Aboriginal Health Organization.
- Narva, A. S. (2002). "Kidney disease in Native Americans." *Journal of the National Medical Association* 94(8): 738-742.
- Narva, A. S. and T. D. Sequist (2010). "Reducing Health Disparities in American Indians With Chronic Kidney Disease." *Seminars in Nephrology* 30(1): 19-25.
- Ng, C., T. K. Young, and P. N. Corey. (2010). Associations of television viewing, physical activity and dietary behaviours with obesity in Aboriginal and non-Aboriginal Canadian youth. *Public Health Nutrition*. 13(9):1430-1437.
- Oster, R. T. and E. L. Toth (2009). "Differences in the prevalence of diabetes risk-factors among First Nation, Metis and non-Aboriginal adults attending screening clinics in rural Alberta, Canada." *Rural and Remote Health* 9(2).
- Oster, R. T., S. Shade, et al. (2010). "Improvements in Indicators of Diabetes-related Health Status Among First Nations Individuals Enrolled in a Community-driven Diabetes Complications Mobile Screening Program in Alberta, Canada." *Canadian Journal of Public Health-Revue Canadienne De Sante Publique* 101(5): 410-414.
- Postl, B., M. Moffatt, and P. Sarsfield, (1987) Epidemiology and interventions for native Canadians. *Can J Public Health*, 78(4): p. 219-22.
- Ralph-Campbell, K., R. T. Oster, et al. (2009). "Increasing Rates of Diabetes and Cardiovascular Risk in Metis Settlements in Northern Alberta." *International Journal of Circumpolar Health* 68(5): 433-442.
- Ralph-Campbell, K., S. L. Pohar, et al. (2006). "Aboriginal participation in the DOVE study." *Canadian Journal of Public Health Revue Canadienne de Sante Publique* 97(4): 305-309.
- Shah, P. S., J. M. Zao, et al. (2011) "Pregnancy and Neonatal Outcomes of Aboriginal Women: A Systematic Review and Meta-Analysis." *Womens Health Issues* 21(1): 28-39.
- Shahan, K. M. (2010). Health disparity in native Hawaiians diagnosed with diabetes. 70: 3195.
- Smeja, C. and P. Brassard, (2000) Tuberculosis infection in an Aboriginal (First Nations) population of Canada. *Int J Tuberc LungDis*, 4(10): p. 925-30.

Su, T. C., L. C. Hwang, et al. (2009). "Ethnic variation in hypertension prevalence of women in Taiwan." *Journal of Human Hypertension* 23(3): 160-167.

Sun, Z. L. (2010) "Quality assessment and improvement in diabetes care - an issue now and for the future." *Diabetes-Metabolism Research and Reviews* 26(6): 446-447.

Tobe, S., L. Vincent, et al. (2010) "Blood Pressure 2 Years after a Chronic Diseases Management Intervention Study." *International Journal of Circumpolar Health* 69(1): 50-60.

Tomlin, A., M. Tilyard, et al. (2006). "Health status of New Zealand European, Maori, and Pacific patients with diabetes at 242 New Zealand general practices." *New Zealand Medical Journal* 119(1235): U2004.

Uauy, R., C. Albala, et al. (2001). "Obesity trends in Latin America: transiting from under- to overweight." *Journal of Nutrition* 131(3): 893S-899S.

Waldram, J.B., D.A. Herring, and T.K. Young, (2006) *Aboriginal Health in Canada: Historical, Cultural and Epidemiological Perspectives*. 2 ed: University of Toronto Press.

Webster, P., (2005) Minority health care remains a problem for Canada's leaders. *The Lancet*, 365(9470): p. 1531-1532.

World Health Organization. (2005) *Preventing chronic diseases : a vital investment : WHO global report*. ISBN 92 4 156300 1

Yeates, K. and M. Tonelli (2010). "Chronic kidney disease among Aboriginal people living in Canada." *Clinical Nephrology* 74: S57- S60.

Young, T. K., J. Reading, et al. (2000). "Type 2 diabetes mellitus in Canada's first nations: status of an epidemic in progress." *CMAJ* 163(5): 561-6.