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Résumé

Considérer les maladies cardiovasculaires et le diabète chez les membres des Premières nations selon une perspective de cycle de vie

Andrew Kmetic, Jeffrey Reading et Elizabeth Estey

Le poids des maladies cardiovasculaires et du diabète, ainsi que les facteurs de risques associés tels l'obésité, le tabagisme, l'intolérance au glucose, l'hypertension et les facteurs alimentaires, présentent une combinaison de facteurs préjudiciables pour la santé des membres des Premières nations du Canada, dans l'immédiat et à long terme. Les auteurs adoptent une perspective de cycle de vie, pour examiner les effets à long terme sur la santé développementale et le risque de maladie ultérieur, des facteurs de risques qui sont prévalents durant la gestation, l'enfance, l'adolescence, la vie de jeune adulte et la vie adulte. Il en résulte une perspective élargie pouvant engendrer des approches novatrices pour aborder la maladie chronique chez la population autochtone du Canada.

Mots-clés : santé des membres des Premières nations, cycle de vie, maladie chronique, cardiovasculaire, diabète

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Taking a Life Course Perspective on Cardiovascular Disease and Diabetes in First Nations Peoples

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The burden of cardiovascular disease and diabetes and associated risk factors, such as obesity, smoking, impaired glucose tolerance, hypertension, and dietary factors, present a mix of factors that are detrimental to the immediate and long-term health of First Nations peoples in Canada. The authors use a life course perspective to examine the long-term effects of risk factors that are prevalent during gestation, childhood, adolescence, young adulthood, and adult life on developmental health and later disease risk. The resultant broader perspective may generate innovative approaches to addressing chronic disease in Canada's Aboriginal population.

Keywords: Aboriginal health, life course, chronic disease, cardiovascular, diabetes

Introduction

In addressing the problems of chronic disease during the 20th century, epidemiologists, health professionals, and policy-makers targeted adult risk factors such as obesity, physical inactivity, high blood pressure, high cholesterol, high blood glucose levels, and smoking (Kuh, Ben-Shlomo, & Lynch, 2004). In the developed world, this approach and its programs have been successful in alleviating many problems associated with chronic diseases. Results from the 40-year Framingham Heart Study indicate that, in the United States, more than one half of the decline in mortality due to coronary heart disease observed in women and one third to one half of the decline observed in men has been attributed to modification of adult risk factors (Sytkowski, D'Agostino, Belanger, & Kannel, 1996). However, the overall reduction in adult risk factors and chronic disease is limited to specific populations. While rates for some chronic diseases have declined in Western populations, chronic diseases are a growing cause of mortality and morbidity among marginalized populations such as Canada's Aboriginal peoples (First Nations, Inuit, and Métis) (Smeja & Brassard, 2000). In 1991, 31% of Aboriginal adults reported having a chronic health problem; in 2002/03, 63.7% of Aboriginal adults reported at least one long-term health condition (First Nations Centre, 2005). The health and well-being of Aboriginal peoples in Canada is comparable to that of people in developing nations (Cooke, Beavon, & McHardy, 2004).

While overall mortality from all causes has declined within the First Nations population, the severity of chronic diseases has grown. In the year 2000, for example, circulatory diseases accounted for approximately 30% of all deaths within the First Nations population (Waldram, Herring, & Young, 2006).

Diabetes is a major risk factor for cardiovascular disease (CVD) in the Aboriginal population (First Nations Centre, 2005; Harris et al., 2002), highlighting the connection between these two conditions and their common risk factors. In this article we discuss the burden of CVD and diabetes in Aboriginal populations in Canada. We then use a life course epidemiology perspective to examine the literature on the main risk factors, at different life stages, and their potential long-term effects. The usefulness of such a perspective in assessing Aboriginal health has been acknowledged (Estey, Kmetic, & Reading, 2007; Waldram et al., 2006; Wethington, 2005). Because of our use of a life course perspective to engage with the literature on chronic diseases among Aboriginal peoples, this article will be of interest to the nursing research community; the life course approach provides a framework for organizing and examining existing research in order to plan research-based and practice-based activities and to identify knowledge gaps with a view to future research and action.

In the last 20 years, life course epidemiology has emerged as a comprehensive approach that takes a broader view than the adult risk model described above (Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003). Life course epidemiology has been defined as the study of long-term effects of physical and/or social exposures during gestation, childhood, adolescence, young adulthood, and adult life on one's developmental health and disease risk (Kuh et al., 2003). It offers a way to conceptualize how underlying socio-environmental determinants of health, experienced at different life stages, can differentially influence the development of chronic diseases as they are mediated through proximal specific biological processes (Moore & Davies, 2005). In the study of CVD, for example, life course epidemiology goes beyond classic risk factors such as adult obesity, smoking, high blood pressure, and physical inactivity, to consider the role of intrauterine nutrition, birth weight, childhood obesity, smoking initiation ages and rates, adolescent blood pressure, and socio-economic status across the life course (Kuh et al., 2004). While adult risk factors are an important piece of the chronic disease "puzzle," life course epidemiology views the interaction of social, biological, and psychological events over time as equally critical. Despite the potential of life course epidemiology for mapping and comprehending the complexities of Aboriginal health issues, such an approach has not been used with Aboriginal populations in Canada. Taking a broad life course perspective,

this article focuses on biological risk factors. It would require an entire article to fully discuss the implications of the social determinants of health and their interaction with biological risk factors. In the meantime, this article may help to inspire confidence in and support for life course research in Aboriginal health.

We caution against the use of general statements about the health conditions of Aboriginal people as a whole. Given the great diversity of Aboriginal peoples in Canada, health status can vary significantly across and within Aboriginal communities. What is true generally may not be true or relevant for a specific group or community. For example, the prevalence of diabetes has been found to vary according to ancestry, language group, cultural grouping, geographic location, and socio-economic status (Delisle, Rivard, & Ekoe, 1995; First Nations Centre, 2005). While the goal of this article is to address CVD and diabetes in the Aboriginal population in general, reference will be made to particular groups (i.e., First Nations, Métis, and Inuit) in accordance with the research literature being cited.

Cardiovascular Disease in Aboriginal Populations

The most common type of CVD is coronary heart disease, also referred to as ischemic heart disease or coronary artery disease. Although the exact cause of CVD is unknown, a number of risk factors have been identified; these include high cholesterol, high blood pressure, smoking, diabetes mellitus, and low levels of high-density lipoproteins. A number of these factors are linked to lifestyle and socio-economic status (Dorner & Rieder, 2004; Sonmez et al., 2004). In many Aboriginal populations, however, these risk factors stem from the ongoing effects of colonialism (Waldram et al., 2006).

In the past several decades, political, social, and economic changes experienced by many Aboriginal populations as a result of increasing "Westernization" and acculturation have manifested in nutritional and behavioural changes such as a calorie-dense and sedentary lifestyle (Anand et al., 2001). These changes have contributed to an increase in CVD (Anand et al., 2001; Shah, Hux, & Zinman, 2000; Yusuf, Reddy, Ounpuu, & Anand, 2001). The 2002/03 First Nations Regional Longitudinal Health Survey (First Nations Centre, 2005), which documents self-reported heart conditions in First Nations communities, shows a prevalence slightly higher than that for the Canadian population (7.6% vs. 5.6%); however, First Nations adults aged 50 to 59 years show a prevalence of 11.5%, compared to 5.5% for the general population. In addition, in a study of 41 First Nations communities in the province of Ontario, CVD hospitalization rates were found to have doubled, from 76

per 10,000 persons in 1984 to 186 per 10,000 in 1995, while declining in the rest of the province (Harris et al., 2002; Shah et al., 2000). A parallel trend was found in the admission rates for acute myocardial infarction (Shah et al., 2000).

Diabetes in Aboriginal Populations

Type 2 diabetes is a metabolic disorder characterized by insulin resistance, relative insulin deficiency, and hyperglycemia (elevated blood glucose). When blood glucose levels become extremely high, excess glucose can cause damage to the body. If blood glucose levels remain high for years, blood vessels and nerves may become damaged, increasing the risk for eye, heart, blood vessel, nerve, and kidney disease (Burant & American Diabetes Association, 2004). Type 2 diabetes typically appears in adulthood and is exacerbated by obesity, inactive lifestyle, stress, depression, and poor diet (Barnett & Kumar, 2004). Since chronic obesity leads to increased insulin resistance, which can develop into diabetes, these two conditions are often co-morbid and interconnected (Lazar, 2005). The association between obesity and diabetes is not definitively known, but the most likely link is adipose tissue: it has been identified as a source of chemical signals (hormones and cytokines) that render cells resistant to insulin (Lazar, 2005).

In the last half century, type 2 diabetes has emerged as a serious problem in many Aboriginal communities: type 2 diabetes has already reached epidemic proportions (Young, Reading, Elias, & O'Neil, 2000) and its prevalence is expected to rise steadily (Health Canada, 2000). There is recent evidence that 19.7% of First Nations adults have been diagnosed with diabetes, with the figure increasing to 35% for those 55 and older (First Nations Centre, 2005). In certain populations, such as the Oji-Cree, the prevalence of type 2 diabetes and impaired glucose tolerance has been observed to be 40% — among the highest of any subpopulation in the world and five times the Canadian average (Harris, Gittelsohn, et al., 1997). In a study with two Algonquin communities in northeastern Quebec (Delisle et al., 1995) and the Oji-Cree community of Sandy Lake in northwestern Ontario (Harris, Caulfield, Sugamori, Whalen, & Henning, 1997), the prevalence of type 2 diabetes was found to be as high as 80% among women aged 50 to 64.

Diabetes is occurring in much younger age groups in First Nations communities than in the general population. Of those living with diabetes in First Nations communities, more than half (53%) are under 41 and 65% are under 45 (First Nations and Inuit Regional Health Survey National Steering Committee [FNIRHS], 1999). Previously referred to as adult-onset or non-insulin dependent diabetes, type 2 diabetes has typ-

ically not been observed in youths (Health Canada, 2000). However, it has been detected in First Nations children as young as 5 to 8 both in the Island Lake region of northeastern Manitoba (Dean, Mundy, & Moffatt, 1992) and in northern Ontario (Harris, Perkins, & Whalen-Brough, 1996). In addition, screening for diabetes in a remote northern Ojibwa-Cree community using fasting plasma glucose levels revealed a high prevalence rate (3.6%) among girls aged 10 to19 (Dean, 1998; Dean, Young, Flett, & Wood-Steiman, 1998).

A person can have type 2 diabetes for up to 12 years before being diagnosed, and eye damage can occur well before diagnosis, making the need for early diagnosis and screening extremely critical (Harris, 1993; Harris & Eastman, 1996). A study currently underway in the province of Alberta (titled Believing We Can Reduce the Aboriginal Incidence of Diabetes, or BRAID) is assessing the use of portable technology for type 2 diabetes screening and also whether an opportunistic screening approach will result in improved estimation of diabetes prevalence (Kaler, King, & Toth, 2006).

In addition to concerns about its prevalence and increasing incidence, diabetes is associated with severe complications of other chronic diseases (Young, Reading, et al., 2000). In the following section we review the interactions between CVD and diabetes in Aboriginal populations.

Interactions between CVD and Diabetes in Aboriginal Populations

Cardiovascular disease and diabetes are often interconnected and mutually influencing. For instance, a study conducted with Aboriginal people in Manitoba a decade ago estimated that, between 1996 and 2016, diabetes would be responsible for a five-fold increase in stroke and blindness and a ten-fold increase in CVD, dialysis starts, and lower-extremity amputations (Greene, Blanchard, & Wajda, 1999).

The adoption of a Western diet and lifestyle patterns is thought to be putting Inuit communities at increased risk for chronic disease. For example, obesity and physical inactivity have increased in some Inuit communities and the previously below-average incidence of diabetes among Inuit people has been changing at an alarming rate (Young, Moffatt, & O'Neil, 1993). The prevalence of diabetes among the Labrador Inuit climbed from 1.9% of the population in 1991 to 4% in 1999 (Health Canada, 2005). The potential influence of changes in diabetes trends on CVD is worth considering. However, the evidence documenting rates of CVD within Inuit communities is inconclusive. While some authors argue that Inuit people tend to have lower rates of CVD as a result of their traditional marine diet (Dewailly et al., 2001), others

suggest that the scientific evidence for CVD is weak and unreliable (Bjerregaard, Young, & Hegele, 2003). Bjerregaard et al. (2003) suggest a need to reassess the data on CVD in Inuit populations and to re-evaluate the potential of a traditional diet to protect against rapid Westernization and its health risks.

In addition to experiencing an overall higher prevalence of type 2 diabetes (First Nations Centre, 2005), many First Nations women are diagnosed with gestational diabetes mellitus (GDM) (Mohamed & Dooley, 1998), which is defined as any degree of glucose intolerance for which the onset or first recognition occurred during pregnancy (Matthews, 2003). The greatest concerns with GDM are its persistence beyond the gestational period and its effects on the fetus; a study in the Sioux Lookout Zone in Ontario found that 70% of women diagnosed with GDM developed overt diabetes within 3 years of diagnosis (Mohamed & Dooley, 1998). Concerns about women's health extend to CVD as well. Monsalve, Thommasen, Pachev, and Frohlich (2005) note that women are at a disproportionately high risk for CVD as a result of a high prevalence of metabolic syndrome and high triglycerides.

While in this section we have set out the links between CVD and diabetes, in the following section we will review the evidence on diabetes, CVD, and their associated risk factors across the life course. This discussion is intended to provide a more holistic and detailed review of the literature and Aboriginal experiences of health.

A Life Course Perspective on CVD and Diabetes in Aboriginal Populations

In charting the evidence that links events during the life course to diabetes and CVD and their associated risk factors, we will, whenever possible, draw on information from studies involving Aboriginal people. When such information is not available, we will draw from the general health research literature to facilitate the discussion of gaps and areas that call for further research and action.

Intrauterine Effects and Birth Weight

Several studies have illustrated the association between suboptimal patterns of fetal and infant growth and adult chronic disease. These studies lay the foundation for what is known as the "fetal origins hypothesis," which suggests that physiologic or metabolic "programming" during gestation and infancy determines, to a large extent, the occurrence of various chronic diseases, including diabetes and CVD, in later life (Barker, 1995a, 1995b, 1995c; Hales & Barker, 1992).

Birth weight is typically used as an indicator of intrauterine conditions and fetal growth, and is thought to relate to the development of many chronic diseases. A number of studies report a strong link between low birth weight and the occurrence of heart disease and hypertension later in life (Barker, 1995a, 1995b, 1995c; Fall, Vijayakumar, Barker, Osmond, & Duggleby, 1995).

High (> 4,000 grams) or low (< 2,500 grams) birth weight has been shown to be associated with increased risk for diabetes in later life (Pettitt, Forman, Hanson, Knowler, & Bennett, 1997; Pettitt & Knowler, 1998). Despite Aboriginal women's increased smoking during pregnancy, which has been shown to decrease birth weight, Aboriginal and non-Aboriginal populations have similar proportions of low birth weight (Gilchrist et al., 2004; Pirogowicz et al., 2004; Wenman, Joffres, & Tataryn, 2004). However, First Nations babies are almost twice as likely as non-Aboriginal babies to be classified as high birth weight (Rodrigues, Robinson, Kramer, & Gray-Donald, 2000). A study of First Nations births in the province of Saskatchewan from 1950 to 1984 found an association between high (but not low) birth weight and diabetes for Saskatchewan Registered First Nations (OR 1.63 [95% CI 1.20, 2.24]), which was stronger for female infants (Dyck, Klomp, & Tan, 2001); the researchers suggest that excess fetal nutrition is the overriding intrauterine factor in the pathogenesis of type 2 diabetes in the First Nations population. As Aboriginal birth weights are being classified as high, normal, or low using non-Aboriginal standards, birth weight correlations should be considered preliminary at best.

Maternal Diabetes

A condition that is more moderate than type 2 diabetes, but with similar risk factors and effects, is impaired glucose tolerance (IGT). IGT is a condition in which the blood glucose level is higher than normal but not high enough to be diagnosed as type 2 diabetes (Matthews, 2003); it is sometimes referred to as borderline or chemical diabetes. IGT has the potential to develop into full-blown diabetes with its resultant chronic conditions.

Glucose tolerance is known to deteriorate in all pregnant women in response to the physiological and hormonal changes that accompany pregnancy (Hod, 2003). In approximately 2% to 3% of pregnancies in the Western world, the deterioration occurs at a level sufficient to fulfil the diagnostic criteria for gestational diabetes (Whitaker, Pepe, Seidel, Wright, & Knopp, 1998). In gestational diabetes, while high levels of maternal glucose are freely transferred to the fetus, maternal insulin cannot cross the placenta (Freinkel, 1980). The developing fetal pancreas responds to the exaggerated glucose load of the diabetic mother by producing insulin,

which, in addition to its hypoglycemic effects, acts as a fetal growth hormone (Pederson, 1954).

It is difficult to determine actual prevalence rates for gestational diabetes, as first-time diagnoses of type 2 diabetes, and not etiologic GDM, could be contributing to the high rates of GDM observed in many Aboriginal communities. Surveys conducted in northern Quebec and northern Ontario suggest that, among Aboriginal women, gestational diabetes may affect up to 13% of pregnancies (Godwin, Muirhead, Huynh, Helt, & Grimmer, 1999; Harris, Caulfield, et al., 1997; Rodrigues, Robinson, & Gray-Donald, 1999). However, just under half of all pregnancies among women over the age of 35 are associated with either pre-existing type 2 diabetes or gestational diabetes (Harris, Gittelsohn, et al., 1997). In a study carried out recently in Saskatchewan, the prevalence rates, risk factors, and outcomes of GDM in Aboriginal and non-Aboriginal women were directly compared for the first time. Among residents of the Saskatoon District Health region, the 1-year prevalence rates for GDM were 6.4% for Aboriginal women and 3.7% for non-Aboriginal women; among residents outside this region, the corresponding rates were 22.8% and 3.1% (Dyck, Klomp, Tan, Turnell, & Boctor, 2002).

While maternal diabetes is a concern among Aboriginal communities (Mohamed & Dooley, 1998), it is also a strong predictor of high birth weight (Godwin et al., 1999; Harris, Gittelsohn, et al., 1997; Rodrigues, Robinson, Ghezzo, & Gray-Donald, 1999). The prevalence of maternal diabetes in Aboriginal populations and its effects on birth weight are highlighted in a Saskatchewan study with First Nations women: infants from GDM pregnancies were found to be 2.4 times more likely to have high birth weight (> 4,000 grams) (95% CI: 1.1, 5.6) than their non-GDM counterparts (Dyck et al., 2001).

In addition to increased rates of high birth weight, offspring of women with GDM may have increased IGT, increased rates of childhood obesity, and increased risk of type 2 diabetes (Pettitt & Knowler, 1998; Silverman, Rizzo, Cho, & Metzger, 1998). In a study with Pima Indians, Dabelea et al. (2000) examined families in which some siblings were born before the mother was diagnosed with diabetes and some after. Children exposed to diabetes in utero had a higher body mass index than their unexposed siblings, and four times the risk of diabetes. Dabelea and Pettitt (2001) conclude that approximately 40% of type 2 diabetes among Pima children aged 5 to19 can be attributed to maternal diabetes during pregnancy. These results highlight the role that the fetal environment can play in an individual's health later in life. Canadian studies examining the relevance of these results would be useful.

Some studies suggest that early detection of GDM coupled with a proper diet and healthy lifestyle can reduce the negative fetal outcomes associated with GDM (Jovanovic-Peterson, 1994). For obese women with GDM, calorie restriction, especially with regard to carbohydrates, can reduce hyperglycemia (Farquhar, 1969) and improve maternal and fetal health outcomes (Cummins & Norrish, 1980). Interventions focused on prevention and early detection are therefore essential.

Maternal Obesity

Obesity is a risk factor for both gestational and type 2 diabetes. Further, maternal diabetes results in high birth weight, which is associated with obesity and the development of type 2 diabetes in offspring. Thus, obesity can be considered a multigenerational risk factor for diabetes and its associated co-morbidities, including CVD. This situation illustrates the need to target obesity and gestational diabetes through a life course approach.

Some studies suggest that maternal obesity, which is often associated with GDM, may be the overriding factor in mediating obesity in offspring (Boney, Verma, Tucker, & Vohr, 2005; Whitaker et al., 1998). An American study that followed children from birth to 6 or 12 years of age found that GDM was not independently significant in increasing metabolic syndrome risk in children but that offspring of obese mothers faced a two-fold increased hazard (Boney et al., 2005). Considering the implications of these results for Aboriginal populations in Canada, pre-pregnancy and pregnancy could be extremely effective points in the life course to target obesity and thus reduce the burden of type 2 diabetes throughout adolescence and adulthood. While the research reviewed above shows that targeting maternal health is central to a life course approach to Aboriginal health, maternal health is best achieved through attention to community health.

Breastfeeding

The protective effects of breastfeeding have been noted by Health Canada, especially within the Aboriginal population (Breastfeeding Committee for Canada, 2002; Macaulay, Hanusaik, & Beauvais, 1991; Pettitt et al., 1997). For example, a study with Aboriginal children in Manitoba identified prolonged breastfeeding as a strong protective factor against type 2 diabetes: a child breastfed for more than 12 months was shown to have only 24% of the risk of a bottle-fed child (Young, Chateau, & Zhang, 2002). The protective effects of breastfeeding have also been observed in studies with Pima Indians (Pettitt et al., 1997; Pettitt & Knowler, 1998). Breastfeeding rates are lower for Aboriginal infants (60%) than for infants in the general Canadian population (80%) (First Nations Centre, 2005). The protective effects of breastfeeding could

greatly benefit Aboriginal health, but it is essential that the conditions underlying the differences in breastfeeding rates be understood. Furthermore, research, interventions, and practices should be developed and undertaken in culturally sensitive and appropriate ways.

Childhood, Adolescent, and Adult Obesity

Longitudinal studies with non-Aboriginal people have shown that obesity in childhood and adolescence predicts adult obesity (Guo, Roche, Chumlea, Gardner, & Siervogel, 1994; Serdula et al., 1993), which is associated with type 2 diabetes (Barrett-Connor, 1989) and coronary heart disease (Hubert, Feinleib, McNamara, & Castelli, 1983). While high rates of pediatric obesity have been reported in studies with several racial groups (Kumanyika, 1993), Aboriginal children are at particularly high risk (Bernard, Lavallee, Gray-Donald, & Delisle, 1995). Thus, understanding the etiology of pediatric obesity throughout the life course could have public health implications for Aboriginal children and adults.

Obesity in childhood has been shown to increase the risk of childhood diabetes. A study with First Nations children aged 4 to 19 found alarming obesity rates: 64% of girls and 60% of boys were reported as being obese (Young, Dean, Flett, & Wood-Steiman, 2000). In the Regional Health Survey of 2002/03, however, only slightly more than 14% of those aged 12 to 17 were reported as being obese, suggesting regional variation in obesity among Aboriginal youths (First Nations Centre, 2005).

A study of the correlation between obesity and television viewing undertaken in the Sandy Lake First Nations community (Hanley et al., 2000) found that children who watched more than 5 hours of television per day were associated with a 2.5-fold increase in the risk of becoming overweight, compared to children who watched less than 2 hours per day. In the same study, children with higher fitness levels and greater fibre intake were less likely to be overweight. In another study, overweight Cree school-aged children and adolescents were found to engage in significantly less physical activity and to eat significantly fewer servings of fruits and vegetables than their normal-weight peers (Bernard et al., 1995). Nova Scotia's 1997 First Nations and Inuit Regional Health Survey found that 98% of children watched an average of 2.9 hours of television per day (FNIRHS, 1999).

When asked about the availability of sports and cultural facilities in their community, fewer than half of Ontario Aboriginal youths reported having sports facilities available; the most commonly cited needs were for a community swimming pool, followed by playground equipment, an arena, and drop-in centres (FNIRHS, 1999). As issues of obesity in Aboriginal communities relate to a lack of physical activity and a seden-

tary lifestyle, lack of facilities, and food insecurity and poor nutrition, these areas may be useful targets for research throughout the life course.

Smoking Throughout the Life Course

Smoking is a major health issue among Aboriginal people (FNIRHS, 1999). Although smoking is known to be harmful to one's health and has been associated with the development of chronic disease, there is some debate in the literature about its total impact as a risk for chronic disease. While some of the literature on the association between smoking and chronic disease is reviewed in this section, there is a need for further investigation of this association. The impact of maternal smoking on chronic disease risk is particularly important for understanding early life influences of smoking on chronic disease development in Aboriginal communities, as there is a very high prevalence of maternal smoking in Aboriginal communities (FNIRHS, 1999) — almost double the Canadian average (First Nations Centre, 2004). Individual smoking rates are also an area of potential concern and further research. Most smokers begin smoking by age 15 (Health Canada, 2004), which means that they have virtually an entire lifetime to accumulate risks for chronic diseases associated with smoking environments and activities. As reported by parents in Manitoba, 19% of all Aboriginal children under the age of 18 smoke; the peak age for taking up smoking is 16, with some youths starting as young as 11 (First Nations Centre, 2004.

A clear association has been shown between maternal smoking and intrauterine growth restriction in both Aboriginal and non-Aboriginal populations (Horta, Victora, Menezes, Halpern, & Barros, 1997; Wenman et al., 2004). However, the relationship between maternal smoking and childhood weight is still inconclusive. A large proportion of Aboriginal women continue to smoke throughout pregnancy, which makes understanding the impact of maternal smoking on disease risks, such as low birth weight and obesity (Grove et al., 2001; Reilly et al., 2005; von Kries, Toschke, Koletzko, & Slikker, 2002), relevant for Canada's Aboriginal population.

Smoking is also directly associated with central metabolic syndrome, a condition that has been identified as comprising obesity, dyslipidemia, and insulin resistance (Parker et al., 2003). In a study with 2,273 American adolescents, 5.6% of whom met the criteria for central metabolic syndrome, the prevalence of the condition was 1.2% for those not exposed to tobacco smoke, 5.4% for those exposed to environmental tobacco smoke, and 8.7% for active smokers (Weitzman et al., 2005). The fact that chronic cigarette smoking markedly aggravates insulin resistance in type 2 diabetes patients is another reason to discourage smoking and encourage smoking cessation (Targher et al., 1997). Given the rates of smoking,

obesity, and insulin resistance among Aboriginal youths, research in this area could have profound implications for Aboriginal health.

While the strong association between smoking and CVD is well known (Greenhalgh, 1981; Haustein, 2003; Swales & De Bono, 1993), the effects of smoking on CVD throughout the life course are not. Since quitting smoking greatly reduces the risk of CVD, smoking cessation programs have the potential to substantially lower the risk for this chronic disease. For example, within a year of quitting, a former smoker's risk for heart disease is reduced by nearly 50% (Ghadirian, 2005). A study conducted with men under the age of 55 found that their risk for CVD within the first year of quitting was not significantly different from that of current smokers, but after 2 years the risk declined and was equal to that for non-smokers (Ghadirian, 2005). The residual risk for CVD following smoking cessation is dependent on total previous exposure to tobacco smoke, length of time without cigarettes, and health status at the time of quitting. However, after 10 to 15 years without cigarettes, the health status of most former smokers is not significantly different from that of lifelong non-smokers (Ghadirian, 2005). This means that targeted smoking cessation strategies have the potential to decrease disease risks and promote better health.

Compared to the general population, Canada's Aboriginal population has a much higher proportion of current smokers and lower proportions of former smokers and lifelong non-smokers (First Nations Centre, 2005). While smoking cessation programs are being developed and implemented, given the addictive nature of smoking the key to tackling this serious health risk lies in prevention (Miller Chenier, 1997). Strategies tailored to children and youths are essential, as is the targeting of parents, whose lifestyle patterns are often mimicked by children. In developing and implementing such programs, one should keep in mind the cultural significance of tobacco in many Aboriginal groups as well as the interface between cultural and recreational tobacco use (Daniels, 2003; Winter, 2000).

Conclusion

This review has shown that a life course perspective can assist policy-makers, care providers, and researchers by presenting a broad view of the burden of CVD and diabetes and their associated risk factors. While we have used the life course perspective to organize and assess the literature on CVD and diabetes, it is our hope that this approach will inspire other researchers, practitioners, and policy-makers to examine the burden of disease and design interventions in Aboriginal populations from a broader, more inclusive perspective. In addition to the expanded adult risk model presented as a life course perspective in this article, it is

important to examine the environmental, social, cultural, and political influences on disease risk and resilience. As shown in the literature, the complex interaction of historical and sociopolitical conditions and access to health care are strong indicators of health disparities and inequities (Adelson, 2005; Browne & Smye, 2002). Our exclusion of a discussion on the social determinants of health was purposeful: it is a topic that warrants an article of its own. While we hope that the social determinants of health will continue to receive attention in the Aboriginal health research literature, the purpose of this article was to emphasize the need to rethink the adult risk model and how disease risks are classified and categorized. As life course epidemiology provides a framework for engaging with the social determinants of health, we hope that such research will become a focus in the future.

No discussion of Aboriginal health, however, is complete without reference to the influences of colonialism on the current and future health and well-being of Aboriginal peoples (Brant-Castellano, 2004; Browne & Smye, 2002). In addition to the emotional, spiritual, psychological, and physical impact of colonialism on Aboriginal health, Aboriginal health as a discipline is impacted by this history. In adopting a postcolonial perspective on Aboriginal health, the Aboriginal health research community has acknowledged the need to engage Aboriginal peoples in research — from the development of the research question to the dissemination and evaluation of the results (Brant-Castellano, 2004; Estey, Kmetic, & Reading, 2008). This engagement is necessary for the conduct of ethical research as well as to ensure the relevance of research and the effective use of research findings. The idea of cultural safety in the nursing literature as a means of ensuring effective nursing practice in postcolonial settings embodies a similar perspective (Polaschek, 1998). As nurses are often the first point of contact for Aboriginal patients, the inclusion of theoretical perspectives, such as life course and postcolonialism, is brought to a point of practice through nurses. It is for this reason that we believe the ideas contained in this article will be of interest to the nursing community. For the research community, we hope that this analysis encourages the development of long-term cohort studies in Aboriginal health contexts similar to those in other populations (Sayers et al., 2003).

Finally, we turn to the policy implications of this discussion. We hope that this article will give policy-makers a deeper understanding of the Aboriginal health research landscape and the methodological potential of using a life course perspective to critically appraise and use the research. Acceptance and use of a life course perspective can in turn produce more holistic and long-term interventions and programs that have greater potential to improve the health and well-being of Aboriginal peoples in Canada.

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