The State of Affairs for Cardiovascular Health Research in Indigenous Women in Canada: A Scoping Review

Stephanie A. Prince, PhD,a,b Lisa A. McDonnell, MSc, MBA,a,b Michele A. Turek, MD,a,c,d Sarah Visintini, BA, MLIS,e Amy Nahwegahbow, BA,f Sujane Kandasamy, MSc,g Louise Y. Sun, MD,b,i,j and Thais Coutinho, MD,a,b,d

Abstract

Cardiovascular disease (CVD) is the leading cause of death among Indigenous peoples in Canada. As rates of CVD rise, the impacts among the growing population of Indigenous women will emerge as an important health issue. The objective of this scoping review was to advance the state of knowledge about cardiovascular health research in Indigenous women in Canada. Five databases and grey literature (non—peer reviewed works) were searched to identify all studies that reported on the prevalence, pathophysiology, diagnosis, treatment, or interventions for CVD among adult Indigenous women in Canada, including First Nations, Métis, and Inuit. Searching identified 3194 potential articles; 61 of which were included. The most commonly researched topics were the prevalence of CVD, hypertension, and dyslipidemia. Rates of CVD and associated mortality among Indigenous women appear to have surpassed those of their nonindigenous counterparts. Very little research has examined the pathophysiology, diagnosis, treatment, or interventions for CVD among adult Indigenous women in Canada, reported on the prevalence, pathophysiology, diagnosis, treatment, or interventions for CVD among adult Indigenous women in Canada, and stroke) in recent years is about 5%-6%.2,3 Although the rate of CVD has been declining in Canada among most age groups, Indigenous populations (including First Nations, Inuit, and Métis peoples) have experienced a rise in its prevalence and associated mortality,1 and it has been acknowledged as the leading cause of death among Indigenous peoples in Canada.5

In 2011, according to the National Household Survey, there were almost 1.5 million Indigenous individuals living in Canada; 51.3% of whom were women (based on self-declaration).1 In the same year, Indigenous women and girls represented 4% of the total female population.6 Between 2006 and 2011, the Canadian Indigenous female population
diagnosis, and treatment of CVD. Gaps in the research identified the need for sex-based analyses, comparison with nonindigenous women, comprehensive longitudinal data, assessment of diagnosis criteria, development and evaluation of cardiovascular health interventions, and a better understanding of the role of culture and traditions in the prevention and treatment of CVD among Indigenous women. Although comprehensive CVD data are lacking, rates of CVD among Indigenous women in Canada are rising and are nearing or surpassing those of nonindigenous women. This review serves as a call to action to seek further research on the pathophysiology, diagnosis, and treatment of CVD among Indigenous women from across Canada.

grew by 20%—4 times the rate of the nonindigenous female population—and is expected to continue to increase. As the rates of CVD continue to rise among Indigenous peoples in Canada, the impacts among the growing population of Indigenous women will emerge as an important health issue.

A previous review of research on Indigenous populations in Canada found that in general, research on the health of women and children was disproportionately low compared with that of men. Recommendations from the 2016 Canadian Women’s Heart Health Summit called for needs assessments to determine research gaps in Canada and the advocacy of high-risk groups. The Truth and Reconciliation Commission of Canada in its call to action called for federal government to “establish measurable goals to identify and close gaps in health outcomes between Aboriginal and non-Aboriginal communities and to publish annual progress reports and assess long-term trends.” To date, there has been no consolidation of the state of research on the cardiovascular health of adult Indigenous women in Canada. Therefore, the objective of this scoping review was to summarize the state of knowledge about cardiovascular health research in Indigenous women in Canada to inform the development of a research strategy.

Methods
A scoping review was conducted to provide a map of the evidence to date and to identify gaps in research related to cardiovascular health in Indigenous women in Canada. The review methodology was established a priori.

Study inclusion criteria

Population. Studies were included if the population was identified as being composed of Indigenous (including First Nations, Métis, and Inuit) adult women (mean age ≥ 18 years) in Canada. Articles that reported on combined samples of men and women were included if they provided female-specific data.

CVD outcomes

The review set out to provide a description of the prevalence, pathophysiology, diagnosis, treatment, or interventions for cardiovascular health among adult Indigenous women in Canada. Cardiovascular health topics included coronary artery disease (including angina, myocardial infarction [MI]), stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, heart arrhythmia, congenital heart disease, valvular disease, carditis, aortic aneurysms, peripheral artery disease, thromboembolic disease, and venous thrombosis. CVD risk factors such as hypertension, hypercholesterolemia, and dyslipidemia were included. Health behaviours (eg, physical activity, diet, smoking, alcohol consumption) and other cardiometabolic conditions (eg, diabetes, obesity) were not included because they are more distally related to CVD and outside the scope of the review.

Study design
All experimental (randomized controlled trials, quasi-experimental), observational (prospective, cross-sectional, case studies), and qualitative studies were eligible. Review articles were not included unless they reported on original data; however, their bibliographies were used to identify additional sources.

Publication status and language
Both published (peer-reviewed) and unpublished grey literature (non-peer reviewed) was examined. Although no language restrictions were imposed in the search, only articles published in English or French were included. Conference abstracts were included for full-text screening if they provided sufficient detail to meet the inclusion criteria.

Search strategy
The systematic review search was created by a medical librarian (S.V.) in discussion with authors (S.A.P., L.A.M., M.A.T., S.K., A.N., T.C.). The search was created in Ovid MEDLINE using a combination of key terms and index
headings related to Canada, Canadian Indigenous peoples, and CVD (Supplemental Table S1). The search was informed by several Indigenous and Canadian search filters.12-14 The Canadian filters were tested to ensure that relevant articles were not missed. Once the search was finalized, it was translated to the other bibliographic databases. Searches were conducted August 4, 2017 in MEDLINE (Ovid; 1946-present), EMBASE (Ovid; 1974-September 7, 2016), PsycINFO (Ovid; 1806-July week 5 2017), Cochrane Library (Ovid; CENTRAL July 2017, Cochrane Database of Systematic Reviews [CDSR] 2005-August 2, 2017, Cochrane Methodology Register [CMR] third quarter 2012, Database of Abstracts of Reviews of Effects [DARE] first quarter 2016, Health Technology Assessment Database [HTA] fourth quarter 2016, NHS Economic Evaluation Database [EED] first quarter 2016), and CINAHL (EBSCO) (1981-present). No date limits were applied. A manual search of all articles from inception to August 23, 2017 was conducted for the Journal of Indigenous Health and the Journal of Aboriginal Health. The grey literature included a search of Dissertations & Theses Global (ProQuest) (1957-present) on August 23, 2017 and an advanced Google search (Supplemental Table S1) on September 6, 2017. Screening of the Google search results consisted of a single reviewer (S.A.P.) inspecting the first 2 pages of results and screening the subsequent 2 pages when relevant results were found until no more relevant results were identified. The bibliographies of key studies selected for the review and related reviews were examined to identify further studies.

Selection of studies

Citations were imported into EndNote X7 (Thompson Reuters, San Francisco, CA) and duplicates were removed using the “duplicate” function, through manual inspection, and on import into Covidence (Veritas Health Innovation Ltd, Melbourne, Australia). Covidence software was used to assist in screening. Two reviewers (S.A.P., L.A.M.) independently screened the titles and abstracts of all studies to identify potentially eligible articles. Full texts of all abstracts that met the inclusion criteria or that had insufficient information to judge eligibility in the abstract were obtained and reviewed independently by 2 reviewers (S.A.P., L.A.M.). When disagreements occurred, consensus was achieved through discussion. Reviewers were not blinded to the authors or journals when screening articles. Articles/reports that used the same data source were eligible if they provided information on a different outcome.

Data extraction and analysis

Standardized data extraction forms were completed by S.A.P. and verified by F.K. Information extracted included publication details (authors, publication year), participant characteristics (region, population, age), study/survey name and year, female sample size, study design, cardiovascular health outcome (self-reported or objectively assessed), and a summary of the findings. When several publications reported the same results from the same primary data source, only 1 study per data source/analysis was retained to avoid double counting. The data from all the included studies/reports were charted.

Results

Description of studies

The preliminary search of the electronic databases identified 3193 potentially relevant articles. After removal of duplicates, 2229 articles remained. Screening by title and abstract resulted in the retrieval of 310 full-text articles for detailed assessment. Of these, 61 unique studies and reports met the eligibility criteria.15-72 In addition, results were supplemented by a data table from Statistics Canada that was found during a grey literature search.73 Figure 1 provides a summary of the search process including reasons for excluding studies at each stage. The most common reasons for excluding full texts were the lack of female-specific data or a missing cardiovascular health outcome, or both. Individual study characteristics are presented in Supplemental Table S2.

Data abstraction identified 2 cases in which multiple publications reported on duplicate outcomes from the same data; the articles with the most complete data were retained. 27,43 The included studies were published from 1985-2017, were conducted across the country, and were all written in English. There has been a steady increase in the number of reports with data on cardiovascular health among Indigenous women in Canada over time (Fig. 2). The most common cardiovascular health outcomes reported were prevalence of hypertension (46% of studies), dyslipidemia (20%), and CVD (21%). The majority of studies used an objective assessment of hypertension or dyslipidemia but relied on self-reports of CVD. The most commonly cited source of data was the Nunavik Health Survey.

In total, data from 192,678 participants were reported (not including those in which the sample size was not provided and possible duplication across articles). Sample sizes ranged from 8 1 to 38,200 65 participants. Almost all were cross-sectional (89% of articles), with few reporting on longitudinal data (11%). Most of the research to date has been conducted in Québec (28% of articles) (Fig. 3). First Nations women were the most studied group, and Métis women were the least studied.

Cardiovascular disease

Prevalence and mortality rates of CVD (either combined or separately for heart disease and cerebrovascular disease [CBVD]) were the most common outcomes reported (21% of studies). Figure 4A provides a summary of the 4 studies that reported on the prevalence of combined CVD (heart disease and CBVD). 21,38,40,41 Prevalence of CVD ranged from 0% in a younger (age mean = 38 ± 16 years) sample of First Nations (both on and off the reserve) and Métis women from British Columbia to 20% among a younger (age mean = 36.7 years; 95% confidence interval [CI], 36.2-37.2) sample of Inuit women from Nunavik, Québec. 21,40 Combined data from the 2011-2014 Canadian Community Health Survey (CCHS) identified that the rates of women who self-reported living with CVD (high blood pressure, heart disease, or the effects of stroke) among First Nations living off the reserve, Métis, and Inuit were 17.3/100,000 population (95% CI, 15.4-19.4), 17.2/100,000 population (95% CI, 15.1-19.5) and 15.5/100,000 population (95% CI, 11.4-20.6), respectively (Fig. 5). In comparison, the rate among the nonindigenous
female population was 19.5/100,000 population (95% CI, 19.2-19.8). These rates appear higher than those seen using data from the 2007-2010 CCHS, although it was significant only among Métis women. Differences in rates are most apparent among younger (25-44 years) women. The rates of self-reported CVD were significantly higher among younger First Nations women living off the reserve (9.3/100,000 population; 95% CI, 6.8-12.7), Métis (10.5/100,000 population; 95% CI, 7.2-15.1), and Inuit (12.0/100,000 population; 95% CI, 6.8-20.2) women compared with younger non-indigenous women (4.8/100,000 population; 95% CI, 4.3-5.2). Although rates of CVD and associated mortality among Indigenous women have historically been lower, they continue to rise and are approaching or exceeding those seen among non-indigenous Canadian women.

Several studies compared the rates of CVD and associated mortality between Indigenous and non-indigenous women. Using data from the 1991-2001 Canadian Census Mortality Follow-up Study, rates of diseases of the circulatory system were found to be 1.7 times higher among registered First Nations (rate ratio, 1.74; 95% CI, 1.60-1.89) and Métis (rate ratio, 1.71; 95% CI, 1.42-2.06) women compared with non-indigenous women. Data from the 1991-2006 Canadian Census Mortality and Cancer Follow-up Study found an age-standardized mortality rate (ASMR) for all circulatory diseases of 105.5/100,000 population of First Nations women (95% CI, 96.1-115.8), translating to more than 2 times the potential years of life lost from CVD compared with the non-indigenous population. The data also found that compared with non-indigenous women, the risk of dying of CVD among First Nations women was 76% higher.

Only 1 study was found to have reported on sex differences in the prevalence rate of combined CVDs. Foulds et al.
found that Indigenous men in British Columbia experienced significantly greater rates of CVD compared with Indigenous women.

Heart disease. The majority of studies reported on heart disease separately from CVD. Ten studies (Fig. 4B) reported on the prevalence of heart disease (ischemic heart disease [IHD], self-reported “heart problems,” MI, acute coronary syndrome, and heart failure). 19,20,24,26,36,37,47,52,53 All except 2 studies were informed by self-reported data. Prevalence of heart disease ranged from 2.1% among Inuit women from Nunavik, Québec, who self-reported a history of MI, to 68% among older (≥ 65 years) Métis women from Manitoba, Saskatchewan, and Alberta with diabetes, who self-reported “heart problems.” 26,36 Bruce et al. 26 found that Métis women with diabetes experienced heart problems more often than did those without it. It is not possible to compare the prevalence of heart disease between studies of First Nations, Métis, and Inuit women because of differences in outcome measures, study sampling, and ages.

Findings were conflicting with respect to the rate of heart diseases among Indigenous women compared with the nonindigenous population. Most studies (75%—2 objectively measured and 1 self-reported) reported that Indigenous women experienced greater rates of heart disease than did nonindigenous Canadian women, 19,63,66 whereas 1 reported no difference (based on self-reports). 47 Young et al., 68 in a review article on the health of Canadian Indigenous women, found that the ASMR for IHD had remained less than the Canadian rate between the 1980s and the 2000s. Tjepkema et al., 64 however, found a rate ratio for potential years of life lost from IHD of 1.94 (95% CI, 1.22-3.08) among Métis women and 1.98 (95% CI, 1.05-3.74) among First Nations women compared with nonindigenous women, representing significantly higher potential years of life lost among the Indigenous female population.

Most studies reported that Indigenous women experienced lower rates of heart disease than did Indigenous men. 20,24,37,53 In contrast, 1 study found that the prevalence of heart disease was significantly higher among Inuit women than among Inuit men in the Northwest Territories. 15 Another study found no significant sex differences in the prevalence of MI (women, 2.1% vs men, 2.5%) or “other heart disease” (women, 6.1% vs men, 7.2%) among the Inuit of Nunavik. 35

In a qualitative study among 16 First Nations and Métis women who had self-reported “heart problems” in the previous 5 years, almost every woman was shocked to have acquired heart problems, and many found out about their CVD only after a heart attack. 51 Women indicated a willingness to take medication and improve their heart health; however, they were less interested in the typically recommended heart-healthy lifestyle changes. The historical influences of
Figure 4. (A) Prevalence of combined cardiovascular disease, (B) heart disease, and (C) cerebrovascular disease. *, myocardial infarction; **, other heart disease; †, ischemic heart disease; ‡, other heart problems; +, with diabetes; ++, without diabetes.
colonization and the residential schools influenced their attitudes. The authors noted "...linked her resistance to 'supposedly healthy' lifestyle activities to her experiences in residential schools where she felt 'manipulated to the point of not having a mind of her own....One woman described herself as a 'product of the residential school'; she explicitly framed her heart problems as an additional form of control and colonization." 51

Cerebrovascular disease. Five studies (Fig. 4C) reported on the prevalence of CBVD (including stroke).20,36,37,52,53 Few studies examined how the prevalence of CBVD differed between Indigenous and nonindigenous Canadian women. The prevalence of CBVD was not different between Métis and nonindigenous women,20,63 but it was higher among First Nations women compared with nonindigenous women.48,63 The risk of dying of CBVD was found to be 1.5 to 3.2 times higher among First Nations and Métis than among nonindigenous Canadian women.52,64 Young et al.68 reported that the ASMR for stroke had overtaken the Canadian rate between the 1980s and 2000s. Data from the 1991-2001 Canadian Census Mortality Follow-up Study identified that potential years of life lost from CBVD was higher among First Nations women living on the reserve than among these women living off the reserve.72

Several studies reported on sex differences in the prevalence of CBVD. Dewailly et al.36 reported on data from the Nunavik Health Survey and found that the prevalence of stroke among Inuit women was 3.6%, which was not significantly different from that among Inuit men (4.6%). Also using data from the Nunavik Health Survey, Noel et al.53 found that Inuit women had a significantly lower prevalence of CBVD than did Inuit men. Data from the First Nations Regional Health Survey 2008-2010 found that women reported a significantly lower prevalence of the effects of stroke than did men (1.5% vs 2.5%).37

Arrhythmias. To date, very little research (2 studies) has examined the prevalence or causes of arrhythmias among Indigenous women in Canada. No studies were found to report on atrial fibrillation, ventricular arrhythmias, or pacemaker and implantable cardioverter defibrillation devices. A study involving a small sample of First Nations individuals from Northern British Columbia identified that more women than men were found to carry a genetic mutation associated with long QT syndrome (odds ratio, 2.2; 95% CI, 0.9-5.6).18 These mutations were associated with larger QTc measurements (with mutation, 471 ms vs without mutation, 438 ms; P < 0.0001).18 In a sample of First Nations individuals from James Bay, Quebec, women were found to have a lower prevalence and frequency of premature ventricular contractions (PVCs) than men (32% had > 6 PVCs/h vs 68% of men; P < 0.001).74

Cardiovascular disease risk factors

Hypertension. The prevalence of hypertension was a commonly reported outcome (46% of studies). The majority of studies relied on objectively measured values of blood pressure with cut points of systolic blood pressure (SBP) ≥ 140 mm Hg or diastolic blood pressure (DBP) ≥ 90 mm Hg (or both) used. Figure 6A displays the prevalence of hypertension reported across 28 articles. Prevalence ranged from 2.2% among a sample of pregnant First Nations women (age mean = 25.1 ± 6.2 years) to 75% among a sample of First Nations women with diabetes (age mean = 62 years).52,54 The prevalence of hypertension was identified as being higher among Indigenous women with diabetes than among those

Figure 5. Rates of self-reported cardiovascular disease among First Nations living off the reserve, Métis, Inuit, and non-Aboriginal Canadians in 2007-2010 and 2011-2014 by sex. Data from Canadian Community Health Survey, Statistics Canada.73
without and was found to increase with age.\footnote{26,33} One study found that a large number of Indigenous women had undiagnosed hypertension.

Few studies compared the prevalence of hypertension between Indigenous and nonindigenous women. Two studies found that prevalence of hypertension was higher among First Nations women and found that it was lower among Inuit women compared with nonindigenous women.\footnote{19,47,67} Data from the First Nations Regional Longitudinal Study found that a significantly higher proportion of older (≥ 60 years) First Nations women living on a reserve had hypertension compared with the general population.\footnote{33}

Sex-specific analyses revealed conflicting results with respect to the rates and prevalence of hypertension. Eight studies found no significant difference between sexes,\footnote{15,24,27,31,32,36,59,65} whereas 6 studies found that the rate of hypertension was lower in women than in men (similar age distributions).\footnote{30,38,40,55,56,59,75} In a 1983 study, hypertension was lower in First Nations women than in First Nations men from 15–64 years, but after the age of 65 years, more women than men were identified as being hypertensive.\footnote{30} In a repeated cross-sectional study of First Nations individuals from Manitoba, the crude prevalence of hypertension was found to be no different between men and women in 2002-2003 but was significantly higher among men in 2011-2012 (\(P = 0.015\)).\footnote{59} Women had half the risk of the development of hypertension compared with men (relative risk = 0.48, 95% CI, 0.21–0.96).\footnote{34} Another study found that hypertension was lower only among younger Inuit women compared to younger Inuit men (18–24 years; 2.5% vs 10.0%; \(P = 0.02\)).\footnote{31} Prehypertension (SBP, 120–139 mm Hg or DBP, 80–89 mm Hg, or both) was found to be lower among Inuit women than among Inuit men (22.3% vs 40.9%; \(P < 0.0001\)).\footnote{11}

**Hypertensive disorders of pregnancy.** Only 2 studies reported on the prevalence of hypertensive disorders of pregnancy. Brennand et al.,\footnote{25} in a study among First Nations women from James Bay, Québec, found the prevalence of hypertensive disorders of pregnancy to be 9.7% (pregnancy-induced hypertension, 3.2%; pre-eclampsia, 6.5%). Similarly, Oliveira et al.\footnote{54} in a study of First Nations women from Ontario found that the prevalence of pregnancy-induced hypertension was similar at 3.3%, which was not significantly different from a nonindigenous cohort.

**Dyslipidemia.** The prevalence of dyslipidemia (ie, elevated total cholesterol, low-density lipoprotein cholesterol, low levels of high-density lipoprotein cholesterol [HDL-C]) was one of the most common cardiovascular health outcomes studied. Eleven articles reported on the prevalence of dyslipidemia or hypercholesterolemia among Indigenous women; their findings are displayed in Figure 6B. Prevalence of dyslipidemia ranged from 7% among younger (mean ± standard error = 37.3 ± 0.8 years) Inuit women from Nunavik, Québec to 58% among First Nations women with diabetes (14–92 years).\footnote{25,55}

Only 2 studies were found that compared the rates of dyslipidemia between Indigenous and nonindigenous Canadian women. Compared with nonindigenous women, Indigenous women were found to experience greater rates of elevated levels of cholesterol and dyslipidemia.\footnote{20,25}

Findings for sex differences in dyslipidemia among Indigenous peoples were conflicting. One study found that rates of dyslipidemia were similar between First Nations men and women,\footnote{54} whereas another found that the prevalence was significantly lower among Inuit women than Inuit men.\footnote{53} First Nations women in Manitoba were found to have a significantly higher crude prevalence of dyslipidemia compared with First Nations men in both 2002-2003 and 2011-2012,\footnote{30} but there was no difference in the risk of dyslipidemia developing.\footnote{44} Inuit women from Nunavik, Québec experienced a significantly higher prevalence of elevated total cholesterol and HDL-C and a lower total cholesterol-to-HDL-C ratio compared with that of men.\footnote{30} In contrast, Dewailly et al. found in their study among Inuit individuals from Québec that women had a significantly lower prevalence of low HDL-C compared with Inuit men (2.0% vs 7.6%; \(P = 0.01\)).\footnote{36} In contrast, Delisle et al. found that First Nations women from Québec had a significantly higher prevalence of low HDL-C than did men (65.4% vs 43.4%; \(P < 0.01\)).\footnote{35} Foulds et al.\footnote{30} found no significant sex differences in the prevalence of high total cholesterol or low HDL-C among Indigenous peoples in British Columbia. Among First Nations individuals with diabetes, women were found to have a significantly lower prevalence of an abnormal total cholesterol-to–HDL-C ratio and hypercholesterolemia than did men.\footnote{55,56}

**Pathophysiology of CVD (including genetics)**

Very few studies (\(n = 6\)) reported on the pathophysiology of CVD among Indigenous women in Canada. Of those identified, the outcomes varied from physiological markers of CVD to genetic mutations affecting an individual’s predisposition. One study reported on concentrations of F2-isoprostane, a biomarker of oxidative stress and a risk factor for CVD.\footnote{16} Alkazemi et al.\footnote{16} analyzed data from the International Polar Year Inuit Health Survey, which included 128 women with measured levels of F2-isoprostane. They found that women (28.8 pg/mL; 95% CI, 26.7–31.2) had higher levels of F2-isoprostane than did men (25.2 pg/mL; 95% CI, 23.5–27.0; \(P < 0.05\)).\footnote{16} In a sample of First Nations women from an isolated community in Northern Ontario, Hegele et al.\footnote{43} examined the variations in genes found to be associated with plasma triglyceride levels in other diverse populations. They found that a genetic variation in the C/C genotype of \(APOC3\) position -455 was associated with hypertriglyceridemia among both men and women.\footnote{45}

Riediger et al.\footnote{58} investigated the distribution of high-risk apolipoprotein (apo)A1, apoB, and the ratio of apoB to apoA1 among 253 First Nations women from Manitoba. They found high-risk apoA1, apoB, and the apoB-to-apoA1 ratio among 60%, 12%, and 57% of women, respectively. Significantly more First Nations women than men were found to have high apoA1 values associated with cardiovascular risk (60% vs 35%; \(P < 0.001\)).\footnote{58}

Measurements of atherosclerosis were objectively assessed in 3 studies.\footnote{16,36,41–53} In the Study of Health Assessment and Risk Evaluation in Aboriginal Peoples, atherosclerosis was found to be lower among First Nations women than First Nations men in Ontario (\(\beta = -0.07\); 95% CI, \(-0.107\) to \(-0.04\)).\footnote{17} Maximum carotid artery intima-media thickness was found
to be significantly lower among Inuit women than Inuit men in the Nunavik Inuit Health Survey (0.65 mm vs 0.75 mm; \(P < 0.0001\)). Among a small sample of First Nations and Métis women from British Columbia, average intima-media thickness was 0.57 mm and central pulse wave velocity was 5.1 \(\pm 2.3\) m/s. In the same study, large and small artery compliance was significantly lower in women than in men, and spectral and sequence baroreceptor sensitivity was significantly higher than in men.

### Diagnosis

No studies reported on methods of the diagnosis of CVD among Indigenous women in Canada.

### Treatment/interventions

The age-adjusted hospitalization rate for CVD among Inuit women in the Keewatin region was found to be 843/100,000 population, which was lower than the rates observed in the rest of the Northwest Territories and Canada. In contrast, the hospitalization rates for acute MI among women from areas with a high First Nations population were found to be higher than among those in areas with a low Indigenous population density (rate ratio, 1.9).

Length of hospital stay was found to be similar between women from areas with a high-density First Nations population and those from low-density Indigenous population areas as well as high-density First Nations area men. Rates of coronary angiography (46% vs 55%) and revascularization
with percutaneous coronary intervention and coronary artery bypass grafting (31% vs 39%) were lower among women in high-First Nations areas vs women in areas with low Indigenous populations.66 Furthermore, First Nations women from areas with high Indigenous populations were more likely to travel longer distances to access cardiac care.28 Counil et al.32 found that 6% of Inuit women from Nunavik, Québec were taking lipid-lowering medication; this prevalence was no different from that in men (5%). Valera et al.63 found a 5% prevalence of Inuit women from Nunavik, Québec receiving antihypertensive treatment; this was not significantly different from that in men. Foulds et al.75 found that 60% of Indigenous women from British Columbia were taking antihypertensive medications. In a much smaller sample of 29 First Nations and Métis women from British Columbia, Foulds et al.41 found that the prevalence of women taking antihypertensive medications was 3.4%; however, the rate of hypertension was lower in this sample.

Only 1 study reported on a cardiovascular health promotion program among Indigenous women. The Seven Sister Healthy Heart Pilot Project was “informed by indigenous healing perspectives, transcultural nursing, and feminist theories of health and illness.”71 The project used a community approach and involved Indigenous women leaders and elders as champions of heart health who learned about and tried to improve their own personal risk factors while helping to improve the healthy living practices of their community members.71 The program was a 2-hour weekly women-only group that ran over 8 weeks and included a talking circle, which provided each woman an opportunity to discuss issues about their personal health and well-being and share stories and knowledge. Results from the pilot found that women in the program reported making better food choices and became more aware of the importance of regular exercise and the importance of smoking cessation. Participants reported that the talking circle was the best part of the program.71 No studies reported on rehabilitation services specifically targeted to Indigenous women.

Discussion

This scoping review is the first, to our knowledge, to examine and describe the available literature assessing cardiovascular health research among adult Indigenous women in Canada. Previous reviews have focused on the cardiovascular health of Indigenous men and women combined or on other cardiovascular risk factors.5,8,68,76-78 Results of the present review identified that the prevalence of CVD and some of its risk factors (hypertension and dyslipidemia) are, to date, the most studied outcomes in this population. There was very little research on the pathophysiology or treatment of CVD among Indigenous women, and no studies reported on considerations with respect to the diagnosis of CVD in this population. Most of the research to date has focused on First Nations and Inuit women, especially those from Québec (with little on Métis women), and almost all have used cross-sectional study designs to provide a snapshot of cardiovascular health among this group. Although comprehensive CVD data are lacking for Indigenous women in general, it appears that the rates of CVD among Indigenous women (especially among younger women) in Canada are rising and nearing or surpassing rates among nonindigenous women. Further, the associated mortality from CVD exceeds that seen among nonindigenous women.69-72 Sex differences were noted in several studies for the prevalence of CVD and its risk factors, but the direction of these differences were often conflicting across studies.

The most frequent reason for excluding full texts from the review was a lack of female-specific data. This has been found to be an issue in cardiovascular health research and health research in general.8,9 In fact, the Canadian Institutes for Health Research and the Heart and Stroke Foundation have recently called for greater inclusion of women in studies and for the application of sex- and gender-based analyses, although not mandatory.8 In addition, many articles did not include a comparison group (ie, the general population), making it difficult to comment on differences between Indigenous and nonindigenous women.

Most of the research to date was carried out in Québec and Ontario (Fig. 3), despite the fact that Manitoba and Saskatchewan have the largest populations of Indigenous women.7 Furthermore, the majority was derived from smaller cross-sectional studies, with almost no longitudinal, experimental, or interventional studies. These issues are partially owing to the fact that there are logistical challenges with conducting research in communities that are often located in remote areas.68 For future studies to be successful, they must engage communities using a collaborative and participatory research approach when possible. The Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans has identified that historically, research among Indigenous peoples has been carried out by nonindigenous researchers and have not generally reflected the unique histories, cultures, and traditions of Indigenous peoples.68 Future research should ensure that results benefit communities and provide opportunities for reciprocal learning.

Strengths and limitations

The strengths of this scoping review include a comprehensive search strategy developed by a medical research librarian, a protocol established a priori, and the inclusion of grey literature. Although the review provides a description of the research on cardiovascular outcomes to date, it does not provide a summary of behavioural or other important clinical risk factors (eg, diabetes, metabolic syndrome, obesity) for CVD. High rates of diabetes, obesity, and smoking among Indigenous peoples have been reported.68 Further, rates of obesity have been found to be higher among Indigenous girls and women than in Indigenous boys and men.81 Health behaviours such as diet, physical activity, smoking, and alcohol consumption, as well as diabetes and obesity are all known to play a role in the development of CVD and are, therefore, important factors to consider within the scope of CVD prevention and treatment research in this group. Further, the review did not assess any of the social determinants of health that have been identified as important factors among this population (ie, malnutrition, food insecurity, effects of colonization, racism, language, and cultural barriers to accessing health care). The review relied almost entirely on cross-sectional studies. This study design, while providing a snapshot of the various outcomes among this population, is limited
in its ability to infer causation or to examine trends over time. Repeated cross-sectional studies were used in some instances, but there is still a continued need for longitudinal and experimental studies. Further, much of the data on CVD has relied on self-reported outcomes; this poses a risk because there may be an underdiagnosis of women, and even among those who have been diagnosed, there may be an underawareness of the importance of the condition.

Recommendations

The review helps to identify gaps in the literature and offers several recommendations for future research on the cardiovascular health of Indigenous women in Canada including the following:

1. Future research on the cardiovascular health of Indigenous peoples in Canada should use sex-based analyses to provide male- and female-specific results and identify possible sex differences.
2. There is a need for longitudinal studies with an emphasis on objective measures to provide information on changes in CVD rates over time and interventional outcomes.
3. More population-specific data as well as disaggregated data on First Nations, Métis, and Inuit urban populations is needed.
4. Future studies, when feasible and applicable, should compare findings to nonindigenous women.
5. Research is needed in the areas of hypertensive disorders of pregnancy, arrhythmias, and the pathophysiology of CVD.
6. Research is needed to verify if current CVD and subclinical disease diagnosis methodology and criteria are appropriate for use in this population.
7. Research is needed to understand access to supportive cardiovascular health care.
8. Research is needed to develop, describe, and evaluate cardiovascular health interventions, including preventive and rehabilitative services.
9. Qualitative research is needed to generate a better understanding of the perceptions of CVD and Indigenous life to develop interventions that consider the sociocultural environment.
10. Policy-oriented research is needed to understand the broader impact of policies.
11. Future research needs to use a biological/sociological cultural approach that includes Indigenous women and their communities as partners in the development and execution of studies.

Conclusions

This review found that although comprehensive CVD data are lacking for Indigenous women, it appears that the rates of CVD and its associated mortality among Indigenous women in Canada are rising and are nearing or surpassing rates among nonindigenous women. Most research to date has focused on the prevalence and rates of CVD and its risk factors (hypertension and dyslipidemia). Research gaps include the pathophysiology, treatment, and diagnosis of CVD among Indigenous women and prospective and experimental studies. This review serves as a call to action, seeking further prospective and experimental research on the pathophysiology, diagnosis, and treatment of CVD among Indigenous women from across Canada. It provides a summary of what is known about cardiovascular health and outcomes among this population of Canadian women and serves to highlight important disparities.

Disclosures

The authors have no conflicts of interest to disclose.

Acknowledgements

The authors would like to thank Ms Freya Kelly for her help with data verification and Dr Robert Reid for his critical appraisal of the manuscript.

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