ORIGINAL RESEARCH

Cardiovascular Medication Use and Long-Term Outcomes of First Nations and Non–First Nations Patients Following Diagnostic Angiography: A Retrospective Cohort Study

Lindsey Dahl, MSc; Annette Schultz, PhD, RN; Elizabeth McGibbon, PhD, RN; Jarvis Brownlie, PhD; Catherine Cook, MD, MSc; Basem Elbarouni, MD; Alan Katz, MBChB, MSc; Thang Nguyen, MD; Jo Ann Sawatzky, PhD, RN; Moneca Sinclaire, PhD; Karen Throndson, MN, RN; Heather J. Prior, MSc; Randy Fransoo, PhD

***Background*—**In Canada, First Nations (FN) people are at greater risk of mortality than the general population following index angiography. This disparity has not been investigated while considering guideline-recommended cardiovascular medication use.

***Methods and Results*—**Retrospective analysis of administrative health data investigated patterns of medication dispensation during the first year after index angiography among patients in Manitoba, Canada. Medication possession ratios (MPRs) reflecting the percentage of days in which medications were supplied were calculated separately for β-blockers, angiotensin-converting enzyme inhibitors, statins, and antiplatelets (clopidogrel). Patients were assigned to 1 of 4 categories: (1) not dispensed (0% MPR), (2) low (1–39% MPR), (3) intermediate (40–79% MPR), (4) high (≥80% MPR). Cox regression models that adjusted for MPR categories were used to explore the association between FN patients and both 5-year all-cause mortality and cardiovascular mortality. FN patients were less likely to have an intermediate MPR (odds ratio: 0.75; 95% CI, 0.57–0.99) or a high MPR (odds ratio: 0.64; 95% CI, 0.50–0.81) for statin medications than non-FN patients. FN patients also had higher adjusted risks of all-cause and cardiovascular mortality than non-FN patients (hazard ratio, all-cause: 1.54 [95% CI, 1.25–1.89]; cardiovascular: 1.62 [95% CI, 1.16–2.25]).

***Conclusions*—**FN status was independently associated with intermediate and high MPRs for statins during the first year following index angiography among patients with known ischemic heart disease. Differences in MPR categories did not explain the disparity in all-cause and cardiovascular mortality between the 2 populations. Reduction of cardiovascular disparities may be best addressed using primary prevention strategies that include decolonizing policies and practices. **(*J Am Heart Assoc*. 2019;8:e012040. DOI: 10.1161/JAHA.119.012040.)**

Key Words: angiography • disparities • medication adherence • outcomes research • population studies

Ischemic heart disease (IHD) is a leading cause of mortality worldwide, and ≈2.3 million Canadians live with this disease.[1,2] First Nations (FN) people in Canada are disproportionately affected by IHD,[3,4] which is often attributed to individual lifestyle choices associated with conventional risk factors.[5] However, FN people face unique challenges related to colonialism, such as geographical isolation, racism, food insecurity, and poverty, which negatively affect their overall health and ability to access healthcare services.[6–11] These factors may also explain the lower rates of coronary angiography among FN people compared with non-FN people.[12,13] Given that angiography is used to inform treatment and secondary prevention strategies, improving access to the procedure for FN people may play a significant role in addressing IHD disparities.

To date, research has reported that FN patients who have an angiogram following an acute myocardial infarction (AMI) continue to have a higher risk of long-term mortality and subsequent hospitalizations compared with non-FN patients despite similar revascularization rates.[12,14] However, neither of these studies adjusted for the use of guideline-recommended cardiovascular medications; when prescribed and adhering to, these medications have been shown to be associated with lower mortality and hospitalization rates among patients with IHD.[15–21] Furthermore, possible

From the Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Canada (L.D., A.S., C.C., B.E., A.K., T.N., J.A.S., M.S., H.J.P., R.F.); Faculty of Health Sciences, St. Francis Xavier University, Antigonish, Canada (E.M.); Faculty of Arts, University of Manitoba, Winnipeg, Canada (J.B.); St. Boniface General Hospital, Winnipeg, Canada (B.E., T.N., K.T.); Manitoba Centre for Health Policy, Winnipeg, Canada (A.K., H.J.P., R.F.).

Accompanying Tables S1 through S3 and Figure S1 are available at https://www.ahajournals.org/doi/suppl/10.1161/JAHA.119.012040

Correspondence to: Lindsey Dahl, MSc, CR3023 369 Tache Avenue, Winnipeg, Manitoba, Canada R2H-2A6. E-mail: ldahl@sbrc.ca

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Clinical Perspective

What Is New?

- Differences exist in cardiovascular medication-dispensing patterns between First Nations (FN) and non-FN index angiography patients.
- FN index angiography patients experience worse long-term mortality and hospitalization outcomes than non-FN patients, even after controlling for medication-dispensation patterns.

What Are the Clinical Implications?

- This research demonstrates that the differences in cardiovascular medication-dispensation patterns following angiography explain some but not all of the mortality and health disparities between FN and non-FN patients.
- These findings may contribute to the growing understanding of the impact of colonization on FN peoples and their continuing experience as they navigate the healthcare system and access procedures such as angiography.

differences in the use of these medications between FN and non-FN patients have not been explored.

The aim of this study was to extend our understanding of cardiovascular disparities between FN and non-FN people by addressing 2 objectives: to compare (1) the dispensation of guideline-recommended cardiovascular medications between FN and non-FN IHD patients who underwent index angiography and (2) the long-term mortality and rehospitalization outcomes among FN and non-FN angiography patients while controlling for medication dispensation.

Methods

The data used for this study are owned by the data providers and are not available unless granted approval from the University of Manitoba Education and Nursing Research Ethics Board, the Manitoba Health Information Privacy Committee, and the Health Information Research Governance Committee of Nanaandawewigamig, the First Nations Health and Social Secretariat of Manitoba. The authors do not have any special access privileges that others would not have.

Setting

Manitoba is a centrally located Canadian province with a population of ≈1.3 million people. Almost 11% of the total population in Manitoba is *status FN* (people registered as FN under the Indian Act), one of the largest percentages of the Canadian provinces.[22] Canada has a publicly funded healthcare system that ensures all residents are entitled to insured health services provided by hospitals, physicians, and specialists.[23] The services covered may vary across each provincial and territorial program depending on which services are considered medically necessary. Pharmaceutical coverage also varies across provinces and territories, and Manitoba employs a pharmacare program based on income and the total cost of eligible prescription drugs.[23] Although Manitoba's healthcare program provides coverage for all residents of Manitoba, status FN people on reserve may also receive limited primary health, public health, and health promotion services through federal programs.[24] In addition, status FN people on and off-reserve may be eligible for pharmacare benefits through the federal noninsured health benefits program.[25]

Data Sources

This retrospective cohort study was conducted using health administrative data files housed in the Manitoba Population Research Data Repository at the Manitoba Center for Health Policy (MCHP). Data files in the repository may be linked using scrambled identifiers to maintain patient confidentiality and to allow for long-term outcome assessment while controlling for multiple variables. Patient-level demographic information was retrieved from the Manitoba Health Insurance Registry. Hospital Abstract and Medical Claims data files were used to identify comorbidities, cardiac procedures, and hospitalizations. Medication use was assessed using the Drug Program Information Network (DPIN) data file, which contains medication and patient information for all prescribed medications dispensed to residents of Manitoba at community pharmacies regardless of payer. Data on mortality, including primary cause of death, were derived from the Vital Statistics Mortality Registry. Finally, the Indian Registry System data file, a national database maintained by Department of Indigenous Services Canada containing information on all status FN people in Canada, was used to identify FN patients because information is not recorded in administrative health data collected in Manitoba.

Cohort Definition

The study cohort was derived from all patients aged ≥18 years who underwent coronary angiography between April 1, 2000, and March 31, 2009, in Manitoba (Figure 1). Angiography procedures were identified in the Hospital Abstracts data file using the Canadian Classification of Health Interventions (CCI) procedure code 3.IP.10. In an attempt to capture new episodes of cardiac events, we excluded patients who had an AMI (other than those associated with the angiography admission), percutaneous coronary intervention (PCI), or coronary artery bypass grafting (CABG) in the year before

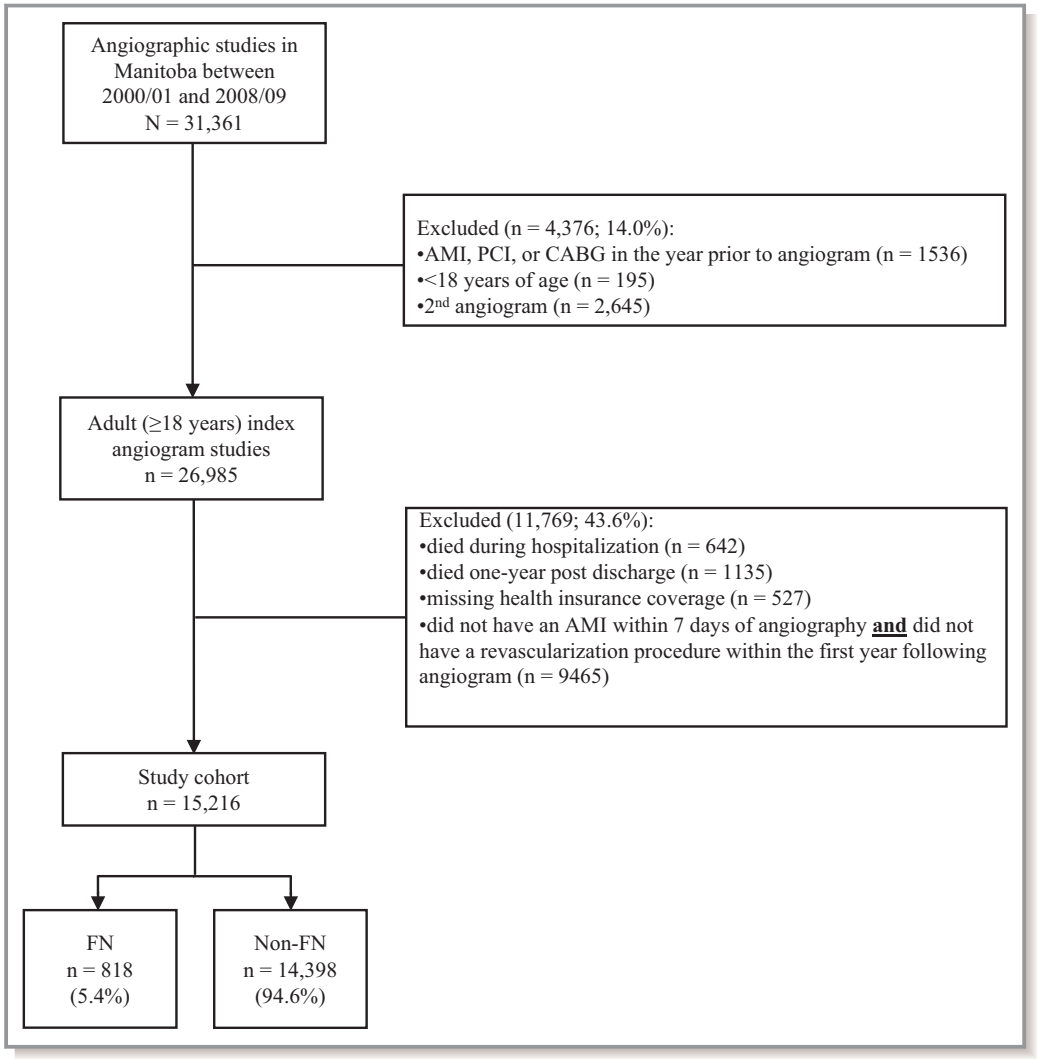

Figure 1. Flowchart of study cohort selection from a population of angiography patients in Manitoba between 2000–2001 and 2008–2009. AMI indicates acute myocardial infarction; CABG, coronary artery bypass grafting; FN, First Nations; PCI, percutaneous coronary intervention.

their "index" angiogram. For patients with >1 angiogram during 2000–2001 to 2008–2009, the first angiogram was used as the index procedure. Among the index angiography patients, to accurately assess medication use over the same length of time for each patient, we excluded those who died during their hospitalization or within the first year following discharge. Those with incomplete or periods of missing health insurance coverage in Manitoba were also excluded. Last, among patients who did not have an AMI within 7 days before their angiogram, those who did not undergo revascularization in the year following angiography were also excluded because they represent a heterogeneous group of patients in which indication of medication prescription is not clear. Thus our study cohort included adult index angiography patients with known IHD defined as having experienced a recent AMI or having stable IHD with an indication for revascularization (n=15 216). This cohort represented patients who were likely candidates for guideline-recommended secondary prevention medications and who shared a similar entry point into the cardiovascular care system.

Outcomes

The primary medication outcome was the dispensation of a medication over the first year following angiography from any of the 4 guideline-recommended cardiovascular drug classes: (1) β-blockers, (2) angiotensin-converting enzyme (ACE) inhibitors, (3) statins, and (4) antiplatelet medications. Dispensations were identified in the DPIN data file according to their World Health Organization's Anatomical Therapeutic Classification (ATC) system code. Although all medications listed in the ATC system for β-blockers, ACE inhibitors, and statins were used for the study, the antiplatelet category was limited to clopidogrel because other common antiplatelets,

such as tricagrelor and prasugrel, were not yet available during the study period, and aspirin use is not fully captured in the DPIN data file. Adherence to prescription was defined using the medication possession ratio (MPR), determined by the number of days of medication supplied divided by 365 days.[26] The number of days supplied indicated on the last prescription fill was truncated at 1 year if it provided medication beyond the first year following angiography. Medications within the same class were considered interchangeable. MPRs were calculated for each medication class separately and used to assign patients to 1 of 4 categories: (1) not dispensed (0% MPR); (2) low (1–39% MPR); (3) intermediate (40–79% MPR); and (4) high (≥80% MPR), consistent with previous studies.[16,27]

The primary health outcomes were 5-year all-cause and cardiovascular-related mortality. Secondary health outcomes included 5-year subsequent hospitalizations for any cause, AMI, congestive heart failure (CHF), IHD, and stroke identified in the hospital abstracts using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* and *Tenth Revision, Canada (ICD-10-CA)* codes (Table S1). The follow-up period for each outcome began 1 year after the index angiography date and ended 5 years later or March 31, 2016 (study termination date), whichever occurred first. The median follow-up time was 4.9 years for the FN and non-FN groups.

Covariates

Baseline characteristics measured at the time of angiography included age, sex, area of residence, area-level income, and level of comorbidity. Area of residence was based on the patient's postal code and corresponding regional health authority. At the time of the study, there were 5 regional health authorities in Manitoba responsible for the administration and delivery of healthcare services within their geographic areas. Area-level income was defined using urban and rural income quintiles based on the patient's postal code and census data. The level of comorbidity was estimated with the Charlson comorbidity index, a reliable and valid prognostic mortality measure that is based on a weighted score from 17 comorbidity categories.[28] Each category comprises specific *ICD-9* and *ICD-10* diagnostic codes,[29] which were identified in the hospital abstracts and medical claims data files for the 5-year period immediately before the index angiography. The frequency of patients in each comorbidity category is presented in Table S2.

A composite measure of revascularization procedures (PCI or CABG) and whether a patient had an AMI within the 7 days before angiography (ie, *recent AMI*), were also used as covariates in the health outcome models. Revascularization procedures in the first year following angiography, including those performed during the index hospitalization, were identified using *ICD-9-CM* (PCI: 36.01–36.03, 36.05–36.07; CABG: 36.10–36.19) and CCI (PCI: 1.IJ.50, 1.IJ.57; CABG: 1.IJ.76) diagnostic codes in the Hospital Abstracts data file. Last, an ordinal variable for each medication class (ie, 4 separate variables) was created and added to the health outcome models to control for medication use. Patients could have a value of 0 to 3 for each variable, reflecting the 4 MPR categories.

Statistical Analysis

Descriptive analyses were conducted to compare baseline characteristics and all other covariates between FN and non-FN patients, using χ^2 tests for categorical variables and *t* tests for continuous variables. Separate multinomial logistic regression models were used to examine the relationship between MPR categories and FN status for each medication class. Each model was adjusted for baseline characteristics and FN status. The odds of FN group being in each of the MPR categories compared with being in the *not dispensed* category were compared with those in the non-FN group and reported as odds ratios (ORs) with 95% CIs. Unadjusted and adjusted Cox proportional hazards models were used to test whether FN status was associated with each primary and secondary health outcome. The first adjusted model controlled for baseline characteristics, recent AMI, and the composite revascularization variable, whereas a second model added the MPR category variables for each medication class. Estimates are presented as hazard ratios (HR) and 95% CIs. Statistical significance for all tests was set at $P<0.05$. All analysis was done on the secure server at the MCHP, using SAS statistical analysis software (v9.4; SAS Institute).

Results

The study cohort consisted of 818 FN patients and 14 398 non-FN patients, and their baseline characteristics are shown in Table 1. FN patients were younger (56.6 versus 63.8 years; $P<0.0001$), less likely to be male (69.2% versus 72.6%; $P=0.03$), and more likely to have a higher Charlson comorbidity index (1.31 versus 0.79; $P<0.0001$), to reside in the Northern Regional Health Authority (38.4% versus 2.3%; $P<0.0001$), and to reside in areas with the lowest average household incomes (59% versus 16.9%; $P<0.0001$). Recent AMI was higher in the FN group (50.4% versus 40.5%; $P<0.0001$). Among those with a recent AMI, a lower proportion of FN patients underwent revascularization in the first year following angiography compared with non-FN patients (73.5% versus 76.9%; $p<0.001$; not shown). In the full cohort, PCI procedures were more frequently performed among non-FN than FN patients (54.0% versus 47.8%;

$P<0.001$), whereas no difference was noted in the proportions of patients undergoing CABG surgeries.

The proportions of FN and non-FN patients who were dispensed a medication from each of the classes separately are shown in Figure 2. Compared with the non-FN group, significantly higher proportions of FN patients were dispensed an ACE inhibitor (81.3% versus 74.8%; $P<0.01$) and clopidogrel (77.5% versus 71.5%; $P<0.001$), and a lower proportion was dispensed a statin (84.8% versus 87.6%; $P<0.05$). To explore this result further, subgroup analyses revealed that the differences for ACE inhibitors and clopidogrel occurred mainly among patients who did not have an AMI and patients who underwent CABG, whereas the difference seen for statins occurred primarily among AMI patients (Figure S1).

There were significant differences in the distribution of patients in the MPR categories for each medication class between groups (Table 2). The percentage of patients in the FN group with >80% MPR was lower for β-blockers and statins and higher for ACE inhibitors and clopidogrel compared with the non-FN group. Among only those who were dispensed a medication, the differences in the distribution of patients in the MPR categories for ACE inhibitors and statins were no longer statistically significant (Table S3).

Figure 3 presents the results from the multinomial analysis examining the effect of the FN group on being in each MPR category compared with the non-FN group. Relative to the not dispensed category, the FN group was less likely to be in the intermediate and high MPR categories for statins compared with the non-FN group (OR, intermediate MPR: 0.75 [95% CI, 0.57–0.99]; high MPR: 0.64 [95% CI, 0.50–0.81]). In addition, the FN group was more likely to be in the intermediate MPR category for clopidogrel relative to being in the not dispensed category compared with the non-FN group (OR: 1.39; 95% CI, 1.05–1.86).

Table 1. Baseline Characteristics of FN and Non-FN Index Angiography Patients

Variable	FN (n=818)		Non-FN (n=14 398)		*P* Value
	n	%	n	%	
Age, y, mean±SD	56.6	10.5	63.8	11.5	<0.0001
Male sex	566	69.2	10 455	72.6	0.0332
RHA					<0.0001
Southern	52	6.4	1775	12.3	
Winnipeg	195	23.8	8752	60.8	
Prairie Mountain	102	12.5	2010	14.0	
Interlake-Eastern	155	19.0	1528	10.6	
Northern	314	38.4	333	2.3	
Average household income quintiles					<0.0001
Rural					
1 (lowest)	354	43.3	688	4.8	
2	105	12.8	1054	7.3	
3	61	7.5	1163	8.1	
4	55	6.7	1182	8.2	
5 (highest)	34	4.2	1039	7.2	
Urban					
1 (lowest)	129	15.8	1739	12.1	
2	33	4.0	1962	13.6	
3	24	2.9	1976	13.7	
4	s		1876	13.0	
5 (highest)	s		1681	11.7	
Charlson comorbidity index score, mean±SD	1.31	1.58	0.79	1.17	<0.0001
Stable IHD with indication for revascularization*	406	49.6	8569	59.5	<0.0001
Recent AMI†	412	50.4	5829	40.5	<0.0001
PCI‡	391	47.8	7781	54.0	<0.001
CABG‡	340	41.6	5613	39.0	0.1413

AMI indicates acute myocardial infarction; CABG, coronary artery bypass grafting; FN, First Nations; IHD, ischemic heart disease; PCI, percutaneous coronary intervention; RHA, regional health authority; s, suppressed due to small cell size (less than or equal to 5).
*No AMI diagnosis within the 7 days before index angiography date.
†AMI diagnosis within the 7 days before index angiography date.
‡Procedure during index year.

Primary Outcomes

A significantly higher proportion of patients in the FN group died during the follow-up period compared with non-FN patients (17.2% versus 12.8%; $P=0.0003$; Table 3). However, the proportion of deaths attributed to cardiovascular causes

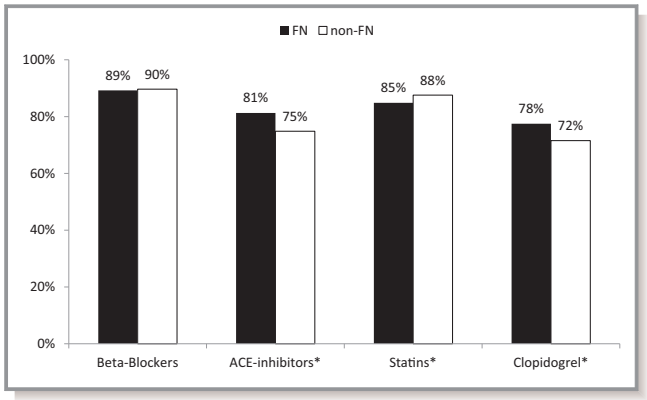

Figure 2. Percentage of patients dispensed a medication during the first year following index angiography. *Significant difference at $P<0.05$ level. ACE indicates angiotensin-converting enzyme; FN, First Nations.

Table 2. Distribution of FN and Non-FN Patients in Each MPR Category for Each Medication Class

Variable	FN n=818		Non-FN n=14 398		*P* Value
	n	%	n	%	
Medication classification					
β-Blockers					0.0092
Not dispensed	88	10.8	1489	10.3	
Low	90	11.0	1175	8.2	
Intermediate	172	21.0	2803	19.5	
High	468	57.2	8931	62.0	
ACE inhibitors					0.0002
Not dispensed	153	18.7	3624	25.2	
Low	84	10.3	1468	10.2	
Intermediate	153	18.7	2265	15.7	
High	428	52.3	7041	48.9	
Statins					0.0197
Not dispensed	124	15.2	1792	12.5	
Low	83	10.2	1294	9.00	
Intermediate	173	21.2	2858	19.9	
High	438	53.6	8454	58.7	
Clopidogrel					<0.0001
Not dispensed	184	22.5	4097	28.5	
Low	159	19.4	2778	19.3	
Intermediate	112	13.7	1374	9.5	
High	363	44.4	6149	42.7	

MPR categories: not dispensed, 0%; low, 1–39%; intermediate, 40–79%; high, ≥80%. ACE indicates angiotensin-converting enzyme; FN, First Nations; MPR, medication possession ratio.

was not statistically different between groups (6.2% versus 5.3%, *P*=0.2254). After adjusting for baseline characteristics, recent AMI, and revascularizations (Figure 4A), FN patients had higher risks of all-cause mortality (HR: 1.63; 95% CI, 1.32–2.00) and cardiovascular mortality (HR: 1.73; 95% CI, 1.25–2.41) compared with non-FN patients. Adding the MPR categories to the model attenuated the relationship between FN status and both mortality outcomes (Figure 4B); however, FN patients continued to have a statistically significant higher risk of all-cause mortality (HR: 1.54; 95% CI, 1.25–1.89) and cardiovascular mortality (HR: 1.62; 95% CI, 1.16–2.25).

Secondary Outcomes

The proportions of FN patients hospitalized for any reason, for AMI, for congestive heart failure, or for IHD during the follow-up period were all higher compared with non-FN patients

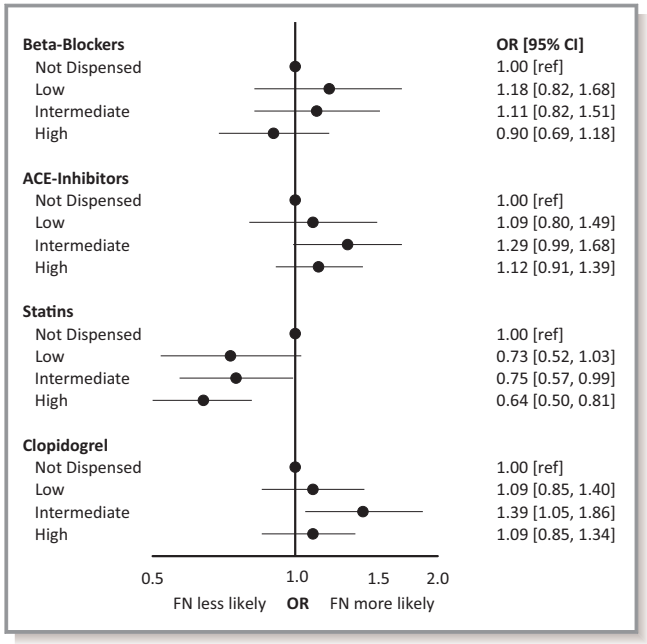

Figure 3. Multinomial logistic regression model results for each medication possession ratio outcome in the 4 medication classifications comparing the FN and non-FN groups. In each model, the category for not being dispensed a medication is the reference category. ACE indicates angiotensin-converting enzyme; FN, First Nations; OR, odds ratio.

(*P*<0.0001; Table 3). The hazards for each hospitalization outcome, except for stroke, were higher for the FN group in the first adjusted model (Figure 4A). The addition of the MPR categories to the model lowered the hazards slightly; however, FN patients were still 53%, 44%, 83%, and 53%

Table 3. Comparison of Mortality and Subsequent Hospitalization Outcome Frequency Between FN and Non-FN Patients

	FN (n=818)		Non-FN (n=14 398)		*P* Value
	n	%	n	%	
Mortality					
All-cause	141	17.2	1845	12.8	0.0003
Cardiovascular	51	6.2	757	5.3	0.2254
Subsequent hospitalization					
Any	544	66.5	7162	49.7	<0.0001
AMI	85	10.4	791	5.5	<0.0001
CHF	84	10.3	683	4.7	<0.0001
IHD	205	25.1	1869	13.0	<0.0001
Stroke	27	3.3	495	3.4	0.8338

AMI indicates acute myocardial infarction; CHF, congestive heart failure; FN, First Nations; IHD, ischemic heart disease.

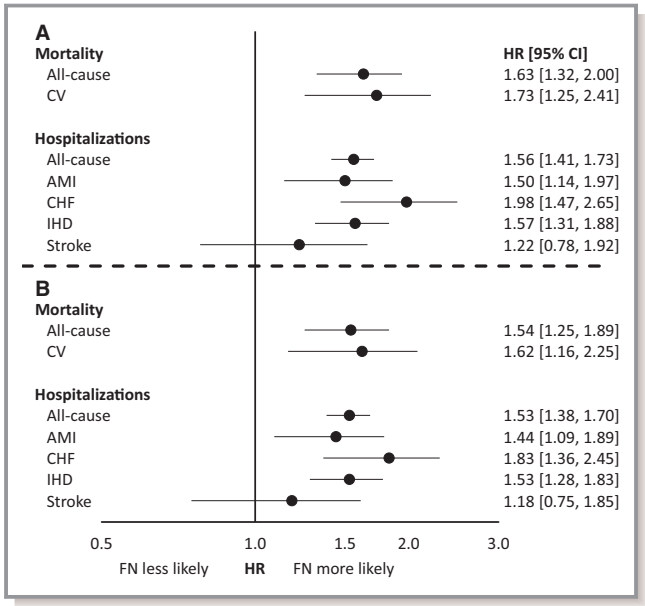

Figure 4. Adjusted hazard ratios for the 5-year mortality and hospitalization outcomes comparing the FN and non-FN groups. **A**, Model 1 adjusted for age, sex, regional health authority, income quintile, Charlson comorbidity index score, recent AMI, and revascularizations. **B**, Model 2 adjusted for age, sex, regional health authority, income quintile, Charlson comorbidity index score, recent AMI, revascularizations, and medication possession ratio categories). AMI indicates acute myocardial infarction; CHF, congestive heart failure; CV, cardiovascular; FN, First Nations; HR, hazard ratio; IHD, ischemic heart disease.

more likely than non-FN patients to experience a subsequent hospitalization for any cause, for AMI, for congestive heart failure, or for IHD, respectively (Figure 4B).

Discussion

In this study we explored patterns in the dispensation of guideline-recommended cardiovascular medications between FN and non-FN patients with known IHD and whether those patterns help explain disparities in other outcomes between groups. Although differences were noted in the distribution of FN and non-FN patients in the MPR categories, no consistent patterns emerged across 4 medication classes studied. After adjusting for baseline sociodemographic variables and comorbidities, the FN group was less likely to attain an intermediate or high MPR for statins compared with the non-FN group. Even after controlling for these differences, FN patients continued to demonstrate a higher risk of mortality and subsequent hospitalizations following index angiography.

The management of IHD often includes prescribing guideline-recommended medications, with the aim of preventing or delaying subsequent cardiovascular events and death.[30,31] The proportions of patients in our study cohort that were dispensed medications from the 4 classes studied were consistent with those reported among acute coronary syndrome patients in Canada.[32] β-Blockers were the most common medication class dispensed following angiography, with ≈90% of patients in both the FN and non-FN groups receiving a medication from this class. Antiplatelet medications were the least common (71% of total cohort); however, as mentioned, the only antiplatelet agent included in the study was clopidogrel. Clopidogrel is recommended for those who are intolerant of or allergic to aspirin and is often used in combination with aspirin for acute coronary syndrome or PCI patients with stents.[33] Despite previous research reporting that a lower proportion of FN patients compared with non-FN patients underwent PCI in the 5 years following angiography,[14] more FN patients in the present study cohort were dispensed clopidogrel, which is counterintuitive to what might be expected. ACE inhibitors were also dispensed to a higher proportion of FN than non-FN patients; this finding may be driven by the higher prevalence of diabetes mellitus among FN people.[34] Interestingly, a lower proportion of FN patients were dispensed statins, which are shown to lower the risk of cardiovascular complications among individuals with diabetes mellitus.[35]

Prescribing guideline-recommended medications is an indicator of good quality of care, but the clinical effectiveness of medications depends on patients actually taking the medications as prescribed.[19] Previous studies have shown that using MPR to measure adherence have found that patients with ≥80% MPR are associated with lower risks of mortality and other adverse outcomes.[16,17,19,36,37] Despite this evidence, consistent cardiovascular medication use in outpatient settings has indicated suboptimal adherence, where approximately a third of patients with IHD were nonadherent after 2 years.[37] In our study cohort, 62%, 49%, 58%, and 43% of all patients had MPRs ≥80% over the first year after angiography for β-blockers, ACE inhibitors, statins, and clopidogrel, respectively, which may also be considered suboptimal. Compared with non-FN patients, there were higher proportions of FN patients with good adherence to ACE inhibitors and clopidogrel and lower proportions with good adherence to β-blockers and statins. The lower likelihoods of having an intermediate or high MPR for statins were still evident after controlling for age, sex, regional health authority, income, and comorbidity score, which may be driven by a higher proportion of FN patients who were not dispensed a statin. Medication prescribing and adherence is complex and involves various factors related to patients and their socioeconomic conditions, the complexity of the therapy regimen, and the healthcare system.[38] For example, confusion may exist regarding prescription medication coverage, given that separate federal and provincial programs provide limited pharmacare benefits to Manitoba residents. Consequently, efforts are needed to improve good adherence for all IHD

patients in Manitoba; however, interventions to achieve this goal must consider that FN and non-FN patients may not have similar access to medications.

Our other objective was to compare mortality and subsequent hospitalizations following index angiography between FN and non-FN IHD patients, controlling for use of cardiovascular medication use. Cardiovascular health disparities between FN and non-FN people in Canada are well documented in the literature,[3–5,10,11,39–41] including patients who have undergone coronary angiography.[12,14] The results in the present study are consistent with these findings and extend our understanding by demonstrating that differences in the pattern of guideline-recommended medication use attenuate but do not completely explain these disparities. Schultz et al[14] found that a lower proportion of FN angiography patients who had an AMI underwent PCI, whereas a higher proportion received CABG procedures compared with non-FN patients; however, controlling baseline characteristics did not indicate a significant difference between the groups. Furthermore, adjusting for revascularization procedures did not explain the mortality disparities between groups.[14] Therefore, although cardiovascular treatment and secondary prevention (ie, revascularizations and/or medications) following angiography are similar between FN and non-FN patients, FN patients continue to experience worse cardiovascular outcomes. It is then reasonable to suggest that differences at the time of angiography, such as the prevalence of known cardiovascular risk factors, likely further explain the health gap between the populations, illustrating the importance of primary prevention. Too often the responsibility of primary prevention (ie, being physical active, maintaining a healthy body weight) falls on the individual while the structural barriers that impede prevention are ignored. For FN people, these barriers are rooted in the historical colonial policies and practices that have led to inequities in the social determinants of health and a disproportionate burden of cardiovascular disease.[5] In 2015 the Truth and Reconciliation Commission of Canada identified 94 Calls to Action for governments, educational and religious institutions, civil society groups, and all Canadians to work toward and facilitate reconciliation.[42] This report provides a foundation for removing the structural barriers faced by FN people and addresses cardiovascular health disparities more constructively than focusing on individual lifestyle "choices."[5]

Several limitations of this study should be considered. Measuring medication use in terms of dispensations and MPRs does not indicate that patients actually took the medications as prescribed; therefore, it is only a proxy for medication adherence.[43] Furthermore, although the dispensation of study medications would have required a prescription, the lack of dispensation is not evidence that a prescription was not written. It is not clear whether improved prescribing or better supports to allow filling of prescriptions would increase MPRs. In addition, administrative data do not contain information on potential adverse reactions, allergies, or intolerance, which may have influenced whether a medication was prescribed or discontinued. The mortality and hospitalization outcomes were observed once the 1-year medication use assessment concluded. It is possible that patient adherence beyond the assessment period (and up to the 5-year end point) may have changed, which could affect the outcomes. However, these medications are often prescribed indefinitely, and the pattern of use has been shown to be relatively stable beyond 1 year of initiating therapy.[44] Medication use before angiography was not measured but may also have influenced the outcomes because some patients may have already begun to accrue benefits from their longer term use. The primary and secondary prevention efforts before angiography require further research. The inability to track over-the-counter medications such as aspirin and the absence of other key clinical variables such as left ventricular function, disease severity, blood pressure, and lipid profiles limited the comprehensiveness of risk adjustment in the analysis. Finally, for patients who were referred for reasons other than IHD (ie, heart failure, valve disease, atypical chest pain) and whose study medication might not be indicated, we excluded patients who did not have a recent myocardial infarction or who were not revascularized. Consequently, some patients with obstructive IHD on angiography who may have undergone only medical therapy would also have been excluded. However, we believe that this group would be only a relatively small number of angiography patients with obstructive IHD.

In conclusion, subtle differences exist in the pattern of cardiovascular medication dispensation between FN and non-FN patients with known IHD during the first year following index angiography. However, these differences were not able to completely explain the poorer outcomes among FN patients. Strategies are required to improve the proportion of all Manitoba patients consistently taking these medications as recommended. However, given differences in coverage and the way medications are accessed by FN and non-FN people, tailored approaches to improve medication adherence for both populations may be required. This approach may lead to better outcomes for all patients, but disparities in adverse health outcomes between populations would likely still exist without acknowledging and addressing the impact of colonization on the health of FN people. Importantly, reducing cardiovascular outcome disparities may best be addressed with primary prevention strategies because secondary prevention and treatment appear to be similar between populations once they become part of the cardiovascular care system.

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Disclosures

None.

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Supplemental Material

Table S1. Data files, diagnostic classification system, and codes used to identify outcomes.

Outcome	Data File	Classification System	Code
AMI	Hospital Abstracts	ICD-9-CM	410
		ICD-10-CA	I21
CHF	Hospital Abstracts	ICD-9-CM	428
		ICD-10-CA	I50
Stroke	Hospital Abstracts	ICD-9-CM	430-438
		ICD-10-CA	I60-I69
IHD	Hospital Abstracts	ICD-9-CM	410-414
		ICD-10-CA	I20-I22, I24, I25

AMI, acute myocardial infarction; CHF, congestive heart failure; IHD, ischemic heart disease.

Table S2. **First Nation and non-First Nation prevalence of individual diagnostic comorbidities used in the Charlson comorbidity index.**

Characteristic	Patient characteristic at index admission, n (%)*				*p*-value
	First Nations n =		Non-First Nations n =		
Charlson Comorbidity Index Score, mean ± SD					<.0001
Myocardial Infarction	82	(10.0)	746	(5.2)	<.0001
Congestive Heart Failure	73	(8.9)	898	(6.2)	0.0022
Peripheral Vascular Disease	35	(4.3)	621	(4.3)	0.9624
Cerebrovascular Disease	31	(3.8)	552	(3.8)	0.9490
Dementia	s	s	69	(0.5)	
Chronic Pulmonary Disease	138	(17.0)	1843	(12.8)	0.0005
Connective Tissue Disease	28	(3.4)	278	(1.9)	0.0031
Peptic Ulcer Disease	21	(2.6)	166	(1.2)	0.0004
Mild Liver Disease	10	(1.2)	98	(0.7)	0.0725
Diabetes without complications	337	(41.2)	2875	(20.0)	<.0001
Diabetes with complications	59	(7.2)	183	(1.3)	<.0001
Paraplegia and Hemiplegia	s	s	32	(0.2)	
Renal Disease	63	(7.7)	297	(2.1)	<.0001
Cancer	23	(2.8)	949	(6.6)	<.0001
Moderate or Severe Liver Disease	s	s	17	(0.1)	
Metastatic Carcinoma	0	(0.0)	32	(0.2)	0.1771
HIV/AIDS	s	s	s	s	

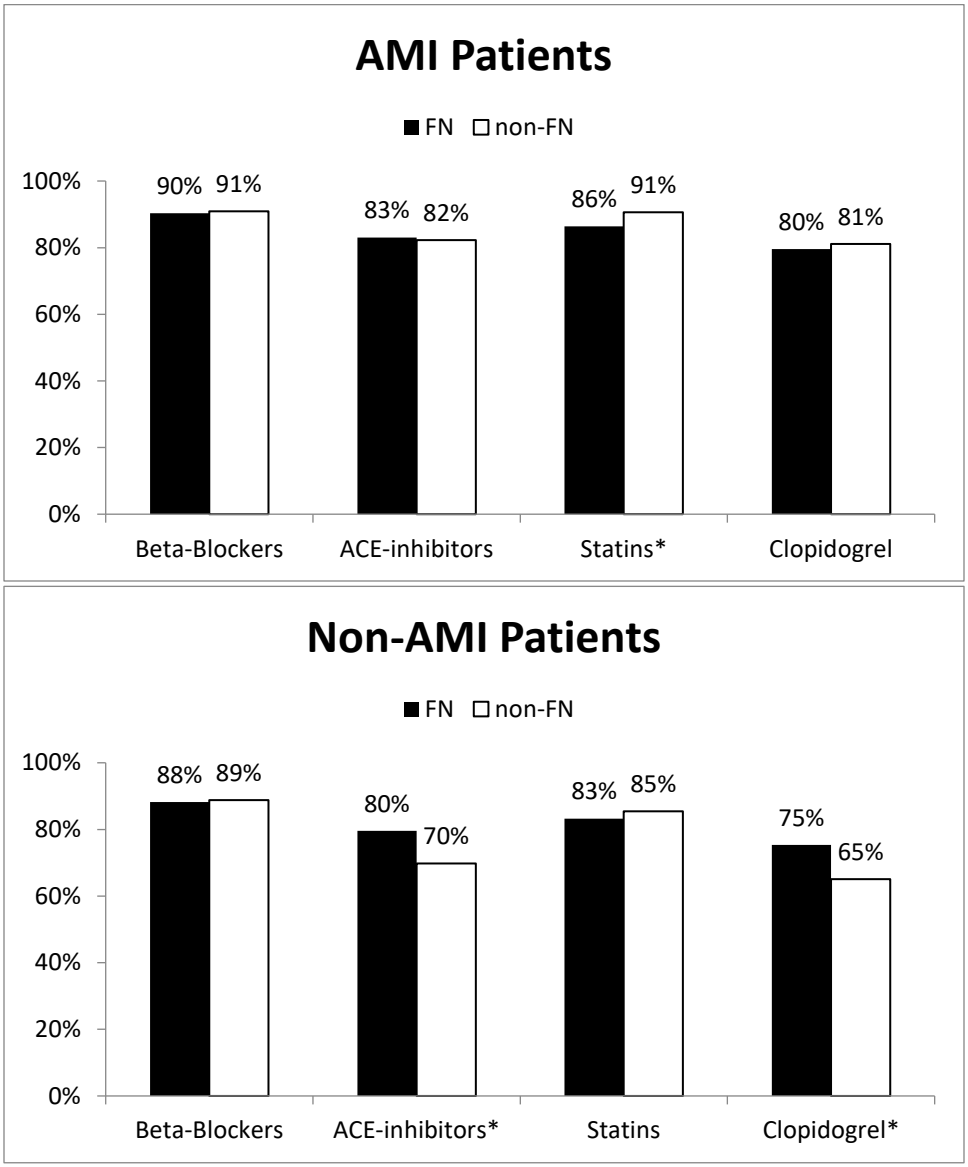
SD, standard deviation; s, suppressed due to small cell size (n ≤ 5).
*Unless otherwise indicated.

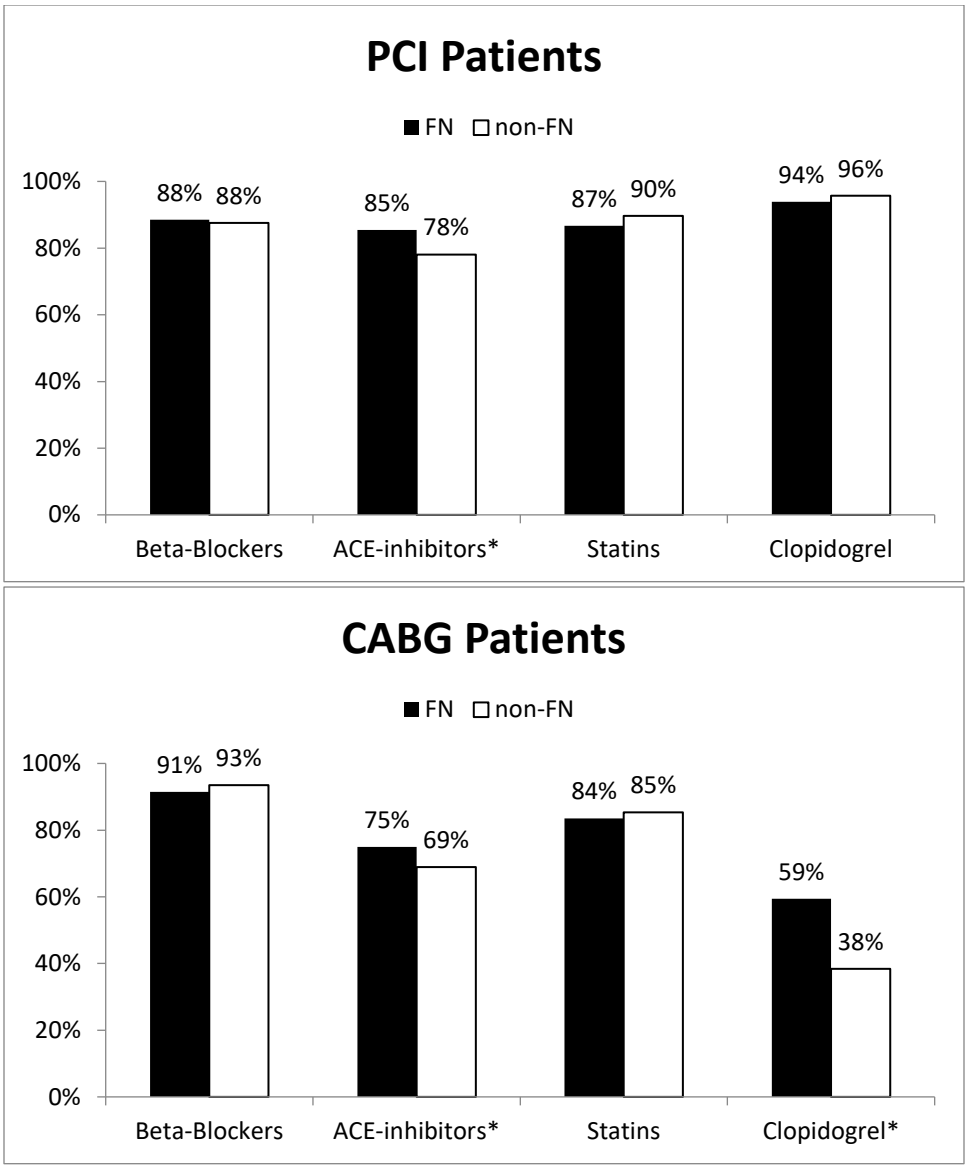
Table S3. **Distribution of patients in each MPR category* who were dispensed a medication at least once in the first-year following angiography, by medication class.**

Variable		First Nations		Non-First Nations		p-value
		N	%	N	%	
Medication Classification						
β-blockers	Total dispensed	730		12,909		0.0033
	Low	90	12.3	1175	9.1	
	Intermediate	172	23.6	2803	21.7	
	High	468	64.1	8931	69.2	
ACE-inhibitors	Total dispensed	665		10,774		0.4237
	Low	84	12.6	1468	13.6	
	Intermediate	153	23.0	2265	21.0	
	High	428	64.4	7041	65.4	
Statins	Total dispensed	694		12,606		0.0894
	Low	83	12.0	1294	10.3	
	Intermediate	173	24.9	2858	22.7	
	High	438	63.1	8454	67.1	
Clopidogrel	Total dispensed	634		10,301		0.0081
	Low	159	25.1	2778	27.0	
	Intermediate	112	17.7	1374	13.3	
	High	363	57.3	6149	59.7	

MPR, medication possession ratio
* Low = 1-39% MPR; Intermediate = 40-79% MPR; High = ≥80% MPR.

Figure S1. Subgroup analysis of separate patient groups.





Percentage of patients who were dispensed a medication from each classification during index year.

* significant difference at $p<0.05$ level.

AMI, acute myocardial infarction; CABG, coronary artery bypass graft; FN, First Nations; PCI, percutaneous coronary intervention.