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Release date: December 20, 2017



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# Hospitalization for ambulatory care sensitive conditions among urban Métis adults

by Gisèle M. Carrière, Mohan B. Kumar and Claudia Sanmartin

## Abstract

**Background:** Hospitalizations for ambulatory care sensitive conditions (ACSCs) are potentially preventable, but may be required if these conditions are not managed well. National-level information about ACSC hospitalizations is available for Canada, but not for Aboriginal groups. This study describes ACSC hospitalizations among urban Métis adults relative to their non-Aboriginal counterparts.

**Data and methods:** The 2006/2007-to-2008/2009 Discharge Abstract Database, which contains hospitalization records from all acute care facilities (excluding Quebec), was linked to the 2006 Census to obtain Aboriginal identity information. Age-standardized ACSC hospitalization rates (ASHRs) per 100,000 population and rate ratios were calculated for Métis aged 18 to 74 relative to non-Aboriginal people of the same ages. Odds of ACSC hospitalizations were estimated using logistic regression models, adjusting for demographic, geographic, and socioeconomic characteristics.

**Results:** The ASHR for ACSCs among urban Métis adults was twice that among non-Aboriginal adults (393 versus 184 per 100,000 population). Even when demographic, geographic, and socioeconomic characteristics were taken into account, Métis had higher odds of ACSC hospitalizations overall (OR 1.5). Most commonly, these hospitalizations were for diabetes (OR 1.8) or chronic obstructive pulmonary disease (OR 1.5). Modelled factors partly reduced differences between Métis and non-Aboriginal adults, but variations between the groups remained after all adjustments.

**Interpretation:** Rates of ACSC hospitalizations were higher among Métis than among non-Aboriginal adults who lived in urban areas. Further research using other data sources is warranted to assess the roles of factors not available for this analysis, such as primary care, co-morbidity, and health behaviours.

**Keywords:** Aboriginal, avoidable hospitalizations, census, chronic obstructive pulmonary disease, data linkage, diabetes, health care

Ambulatory care sensitive conditions (ACSCs) are potentially preventable, but if untreated, can result in high use of health care services.<sup>1,2</sup> In fact, hospitalization rates for ACSCs are used as an indirect measure of the adequacy and accessibility of primary health care.<sup>1,3-6</sup> The people most at risk for ACSC hospitalizations tend to be older; have poorer health, lower socioeconomic status, and co-morbidities; be regular smokers<sup>3,7,8</sup>; and live in rural areas.<sup>9</sup>

An elevated risk of avoidable hospitalizations among the Aboriginal population has been reported in Australia,<sup>8</sup> but analyses by Aboriginal identity have not been conducted for Canada at the national level. This is a concern because the prevalence of potentially treatable conditions such as diabetes, asthma, and cardiovascular disease has been found to be higher among Aboriginal people.<sup>10-13</sup> Moreover, evidence indicates a trend toward a rise in the prevalence of some ACSCs among Aboriginal populations in Canada and elsewhere.<sup>8,14</sup>

Several factors suggest that Métis may be more likely than non-Aboriginal people to be hospitalized for ACSCs. In 2006, 14% of Métis reported having asthma, and 7% reported diabetes; the corresponding figures for the total Canadian population were 8% and 4%.<sup>10</sup> In 2012, daily smoking, an established risk factor for ACSC hospitalization,<sup>3</sup> was reported by 26% of Métis aged 12 or older,<sup>15</sup> compared with 15% of the total population.

The likelihood of receiving primary care and of ACSC hospitalizations may be related to where people live.<sup>9,16-19</sup> While Aboriginal people overall are more likely than non-Aboriginal people to live in rural and remote areas,<sup>20</sup> Métis tend to reside in urban areas<sup>20</sup>; thus, the availability of primary health care may be similar for Métis and non-Aboriginal people.

An Ontario analysis showed that although Métis disproportionately suffer from diabetes,<sup>13</sup> no differences were detected for visits to primary care physicians and specialists, or for retinopathy screening, compared with the total Ontario population.<sup>13,16</sup> However, among Métis with diabetes, hospitalizations were more likely than among Ontarians overall.<sup>21</sup> Similar patterns were reported in Manitoba.<sup>22</sup> Neither study examined ACSC hospitalizations specifically. Moreover, national information about the health service use of Métis is generally lacking.<sup>23</sup>

The objective of this analysis is to determine if Métis are more likely than non-Aboriginal people to be hospitalized for ACSCs and whether differences persist after adjustment for socioeconomic and geographic factors. As well, comorbidity among Métis hospitalized for an ACSC is compared with that of their hospitalized non-Aboriginal counterparts.

The study is based on a linkage of the 2006 Census of Population with the Discharge Abstract Database.<sup>24</sup> This enables identification of ACSC hospitalizations by Aboriginal identity.

## Data and methods

### Data sources

The 2006 Census (long-form) was linked to the Discharge Abstract Database (DAD) for all Canadian jurisdictions, excluding Quebec.<sup>24</sup> The long-form questionnaire collected detailed information, including Aboriginal identity. The long form was completed by about 20% of the non-institutional population, and was administered to (but not necessarily completed by) all of Indian reserves and settlements, and many remote and northern communities.<sup>25</sup>

The DAD is a census of acute care hospital discharges in all provinces and territories (excluding Quebec), provided annually to Statistics Canada by the Canadian Institute for Health Information.<sup>26</sup> The DAD contains demographic, administrative, and clinical data for about 3 million hospital discharges each year. Acute care hospital discharge records for fiscal years 2006/2007 through 2008/2009 were used for the linkage on which this analysis was based.

Among long-form census respondents who identified as Métis, 78.4% were eligible for linkage to the DAD; between 5.7% and 6.4% (depending on the year) linked to at least one acute care hospitalization. Among non-Aboriginal respondents, 94% were eligible for linkage, and between 5.0% and 5.4% linked to at least one hospitalization.<sup>24</sup> Methodological details, including criteria applied to each data source to determine linkage eligibility, are available elsewhere.<sup>24</sup>

The linkage was approved by Statistics Canada's Executive Management Board<sup>27</sup> and is governed by the Directive on Record Linkage.<sup>28</sup> Statistics Canada ensures respondent privacy during linkage and subsequent use of the linked files. Only employees directly involved in the linkage process have access to the unique identifying information (such as name and sex) and do not access health-related information. When a linkage is complete, an analytical file is created from which the identifying information has been removed. This de-identified file is provided to researchers for analysis.

### Study sample

The study cohort consisted of 2006 Census respondents aged 18 to 74 in Census Metropolitan Areas (CMAs) or in zones strongly or moderately influenced by CMAs who reported Métis as a single Aboriginal identity and those who did not identify as Aboriginal ("non-Aboriginal"). Aboriginal identity was derived from the question: "Is this person an Aboriginal person, that is, North American Indian, Métis or Inuit

(Eskimo)?" The Aboriginal identity population consists of people who identified with at least one of the following groups: North American Indian, Métis or Inuit, and/or a Treaty Indian and/or a Registered Indian as defined by the Indian Act of Canada, and/or members of an Indian band or First Nation. Non-Aboriginal people are those who did not report an Aboriginal identity.

Métis identity in this study is based on the date of the 2006 Census (May 16). "Ethnicity mobility" as it pertains to Métis<sup>29</sup> should be taken into account if the findings of this analysis are compared with those for other periods.

Métis tend to be urban-dwellers<sup>20</sup>—in 2006, 69% lived in large cities (CMAs) or smaller urban areas. However, among urban-dwellers, Métis were twice as likely as non-Aboriginal people to live in small urban centres (41% versus 20%).<sup>20</sup> For the present study, the 2006 Census Standard Area Classification (SAC) Type<sup>30</sup> was used to classify census subdivisions (CSDs) according to whether they were a component of one of the following: CMA; census agglomeration (CA); CMA-influenced-zone; or CA-influenced zone.<sup>30,31</sup> In areas outside CMAs and CAs, the Statistical Area Type is defined by characteristics of the CSD based on commuting flows to work in CMAs or CAs, which determine if a CSD is a "metropolitan influenced zone".<sup>30</sup>

To control for potential variations due to unmeasured effects of access to primary care on the likelihood of ACSC hospitalization, this analysis used cohort members who resided in the levels of SAC Type spanning the range from CMA to non-CMA/non-CA areas with either strong or moderate influence from nearby metropolitan areas. Respondents in areas with weak or unknown metropolitan influence, or missing Statistical Area Type information, were not included. The cohort comprised 2.86 million census respondents, 36,700 of whom were Métis (Table 1).

In 2011, Statistics Canada changed the standards for urban versus rural areas; researchers using more recent vintages of data should consult this revised standard.<sup>31</sup>

### What is already known on this subject?

- Less than half of one percent of Canadians younger than 75 are hospitalized for ambulatory care sensitive conditions (ACSCs), but they account for more than one in ten hospital days.
- National-level ACSC hospitalizations have not been estimated for the Aboriginal population

### What does this study add?

- Based on linked data from the 2006 Census and the 2006/2007-to-2008/2009 Discharge Abstract Database, rates of ACSC hospitalization were significantly higher among urban Métis adults (Quebec excluded) than among non-Aboriginal people, even when demographic, socioeconomic, and geographical factors are taken into account.
- The age-standardized ACSC hospitalization rate among Métis was twice as high as that for non-Aboriginal adults.
- Most ACSC hospitalizations were attributable to diabetes, COPD and asthma, with rates two to three times higher among Métis.
- The age-standardized prevalence of at least two comorbidities was higher among Métis than among non-Aboriginal ACSC patients.

### Outcomes

ACSC hospitalizations were those with a "most responsible diagnosis" of diabetes, chronic obstructive pulmonary disease (COPD), asthma, angina, grand mal status and other epileptic convulsions, heart failure and pulmonary edema, or hypertension,<sup>32</sup> coded according to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada (ICD-10-CA)* (Appendix Text Table A).<sup>33</sup> Dichotomous variables were created to indicate if an

**Hospitalization for ambulatory care sensitive conditions among urban Métis adults • Research Article**

individual experienced at least one hospitalization for each condition, as well as for any type of ACSC.

Among those hospitalized for ACSCs, Charlson Index comorbidities<sup>34,35</sup> were determined based on up to 24 diagnoses other than the “most responsible diagnosis” listed on each hospital record (Appendix Text Table B contains ICD-10-CA coding definitions).

**Covariates**

Urban/Rural residence,<sup>36,37</sup> income, education, and employment<sup>38,39</sup> are strongly associated with health. These covariates, derived from linked census information, were used to adjust the regression models.

*Residence* was defined as within CMAs, CAs, or strongly or moderately CMA-influenced areas.

*Household income quintile* was derived at the economic family level or directly for unattached individuals. Total after-tax income from all sources, from all members of each household was summed, adjusted for household size, and divided into *quintiles*. To minimize regional income differences, income quintile thresholds were estimated for each province/territory using the distribution of after-tax income in that province/territory. Individuals were assigned to the quintile in which their household income fell.

*Educational attainment* was the highest level of formal education. Two levels were defined: 1) secondary graduation or more (registered apprenticeship certificate, other trades certificate or diploma, college, CEGEP or other non-university certificate or diploma, university), or 2) less than secondary graduation.

*Labour force status* pertained to the week before the census date (reference week). Three levels were defined: *employed* (worked in reference week); *unemployed* (looking for work, available for work, but did not work); and *not in labour force* (not working, not looking for work, not available for work).

Because research has shown associations between living arrangements and

health outcomes,<sup>40,41</sup> models were adjusted for *household living arrangements*.

**Statistical methods**

Age-standardized hospitalization rates (ASHRs) per 100,000 population and 95% confidence intervals were calculated by Métis and non-Aboriginal identity for ACSCs overall (at least one) and separately for each ACSC. Hospital records for 2006/2007 through 2008/2009 were pooled. ASHRs were computed by dividing hospitalizations of Métis and non-Aboriginal people

(numerator) by the unweighted person estimates from the study cohort for the same identity group (denominator) multiplied by three. Sampling weights account for the survey design and the under- or over-representation of people with certain characteristics. Because census weights were not adjusted for linkage eligibility, the long-form census weights are not representative of the linked cohort. Therefore, this analysis is based on an unweighted linked study cohort.

**Table 1**  
**Selected characteristics of 2006 Census cohort eligible for linkage to Discharge Abstract Database, Métis and non-Aboriginal urban household population aged 18 to 74, Canada excluding Quebec**

Characteristics	Métis		Non-Aboriginal	
	Number	%	Number	%
<b>Total</b>	36,700	100.0	2,827,600	100.0
<b>Hospitalized for ambulatory care sensitive condition</b>	400	1.0	20,300	0.7
<b>Age group</b>				
18 to 20	2,900	8.0	155,800	5.5
21 to 40	16,200	44.0	1,042,100	36.9
41 to 74	17,600	48.0	1,629,800	57.6
<b>Sex</b>				
Men	18,900	51.4	1,444,800	51.1
Women	17,900	48.6	1,382,900	48.9
<b>Province/Territory</b>				
Atlantic	1,100	3.0	236,300	8.4
Ontario	9,000	24.5	1,533,100	54.2
Manitoba	7,300	19.9	111,200	3.9
Saskatchewan	3,900	10.6	81,300	2.9
Alberta	8,800	23.9	373,000	13.2
British Columbia	6,400	17.3	486,700	17.2
Territories	300	0.8	6,000	0.2
<b>Statistical Area Classification Type</b>				
Census Metropolitan Area	20,700	56.4	2,123,400	75.1
Census Agglomeration (tracted)	2,500	6.9	125,800	4.4
Census Agglomeration (untracted)	6,600	18.1	272,700	9.6
Strong Metropolitan-Influenced Zone	1,700	4.6	119,500	4.2
Moderate Metropolitan-Influenced Zone	5,200	14.1	186,300	6.6
<b>Household income quintile</b>				
1 (lowest)	5,100	13.8	259,400	9.2
2	4,500	12.3	237,500	8.4
3	7,000	19.1	463,200	16.4
4	11,400	31.0	904,000	32.0
5	8,700	23.8	963,500	34.1
<b>Educational attainment</b>				
Less than secondary graduation	9,900	26.9	455,300	16.1
Secondary graduation or more	26,800	73.1	2,372,300	83.9
<b>Living arrangements</b>				
Alone	4,300	11.6	298,900	10.6
With others	32,500	88.4	2,528,700	89.4
<b>Labour force status</b>				
Not employed	2,400	6.6	119,100	4.2
Not in labour force	9,100	24.8	725,500	25.7
Employed	25,200	68.6	1,983,000	70.1

**Note:** Population counts rounded to nearest 100

**Sources:** 2006 Census of Population; linked 2006 Census–2006/2007-to-2008/2009 Discharge Abstract Database.

## Hospitalization for ambulatory care sensitive conditions among urban Métis adults • Research Article

The direct method was used to standardize to the age structure of the 2006 Census Aboriginal population. The standard errors to create 95% confidence intervals for ASHRs were derived using methods described by Spiegelman.<sup>42</sup>

Rate ratios (RRs) with 95% confidence intervals were calculated for Métis relative to non-Aboriginal adults.

To determine if factors such as socioeconomic status relate to differences between Métis and non-Aboriginal people in the likelihood of an ACSC hospitalization, multivariate logistic regression models estimated the odds, using the total urban adult non-Aboriginal component of the cohort as the reference group. Five sequential models were estimated, with adjustments for covariates added in the following order: 1) age, sex, and province or territory of residence; 2) SAC Type; 3) per person total household income quintile; 4) educational attainment; and 5) labour force status and living arrangements.

Analyses were completed using SAS version 9.3.

## Results

### Study cohort

Urban Métis study cohort members were slightly younger than their non-Aboriginal counterparts, with median ages of 40 and 44, respectively

(Table 1). One-quarter (24%) of Métis cohort members lived in Ontario, compared with about half (54%) of those who were non-Aboriginal. Just over half (56%) of Métis were in CMAs, and 14% were in zones having moderate metropolitan influence; among non-Aboriginal people, the corresponding figures were 75% and 7%. Métis were more likely than non-Aboriginal people to be in the two lowest income quintiles and to have less than secondary graduation. Similar percentages of each group were employed and lived alone.

### Hospitalization for ACSC

From 2006/2007 through 2008/2009, 8.7% (n = 30,345) of hospitalizations of study cohort members were related to ACSCs. Although Métis made up 1% of the total cohort, they accounted for 2% of ACSC hospitalizations.

The ACSC-related ASHR among Métis was more than twice that of non-Aboriginal people: 393 compared with 184 per 100,000 population (RR 2.14; CI: 1.96 to 2.33) (Table 2). The most pronounced difference was diabetes-related hospitalizations, with rates almost three times higher for Métis: 110 versus 40 per 100,000 (RR 2.75; CI: 2.31 to 3.28). ASHRs among Métis were more than twice as high for COPD-related conditions (RR 2.36; CI: 2.07 to 2.70) and for asthma (RR 2.35; CI: 1.48 to 3.72). Hospitalization rates for all other types of ACSCs were also higher among Métis.

### Characteristics of individuals hospitalized for ACSC

Regardless of whether they were Métis or non-Aboriginal, individuals who experienced at least one ACSC hospitalization tended to be older and male; had lower incomes and less education; were not in the labour force; and lived alone (Table 3). Métis and non-Aboriginal people in zones with only moderate metropolitan influence were more likely to have an ACSC hospitalization than were their counterparts in CMAs.

The prevalence of Charlson Index comorbidities among ACSC patients was higher for Métis than for non-Aboriginal patients (Table 4), but differences were not significant, possibly due to lack of power resulting from small sample size.

### Logistic regression models

Logistic regression models tested whether differences in geographic, demographic, and socioeconomic factors accounted for the higher rates of ACSC hospitalization among Métis. For three outcomes—at least one ACSC hospitalization of any type, a hospitalization related to diabetes, or a hospitalization related to COPD—Métis had higher odds (Table 5). Age-, sex-, and province/territory-adjusted odds for at least one ACSC hospitalization were almost twice as high among Métis as among non-Aboriginal people; for diabetes-related or COPD-related hospitalizations, odds were more than twice as high. Further adjustment for SAC Type reduced the odds for Métis, but they remained significantly higher. Additional adjustment for household income quintile greatly reduced, but did not eliminate, differences between the two groups, as did adjustment for educational attainment. Inclusion of employment status and living arrangements yielded slight reductions. Yet even when all adjustments were applied, significant differences between the two groups remained—for Métis, the adjusted odds of a diabetes-related hospitalization were twice those for non-Aboriginal adults, and the odds of

**Table 2**  
Age-standardized acute care hospitalization rates (ASHRs) per 100,000 and rate ratios (RRs), by cause, Métis and non-Aboriginal urban household population aged 18 to 74, Canada excluding Quebec, 2006/2007 through 2008/2009

Cause of hospitalization	Métis			Non-Aboriginal <sup>†</sup>			Rate ratio		
	ASHR	95% confidence interval		ASHR	95% confidence interval		RR	95% confidence interval	
		from	to		from	to		from	to
All causes (births excluded)	4,867	4,736	5,002	3,128	3,115	3,141	1.56	1.51	1.60
Ambulatory care sensitive condition	393	362	428	184	181	186	2.14	1.96	2.33
Diabetes	110	93	131	40	38	42	2.75	2.31	3.28
Chronic obstructive pulmonary disease	126	111	144	53	52	54	2.36	2.07	2.70
Asthma	26	16	41	11	10	12	2.35	1.48	3.72
Angina	48	39	60	28	27	29	1.73	1.39	2.14
Grand mal status and other epileptic convulsions	23	15	35	13	12	14	1.73	1.14	2.64
Heart failure and pulmonary edema	54	44	66	33	32	34	1.63	1.33	2.00

<sup>†</sup> reference category for rate ratio

Source: Linked 2006 Census–2006/2007-to-2008/2009 Discharge Abstract Database.

**Table 3**  
**Number and percentage hospitalized for ambulatory care sensitive condition (ACSC), by selected characteristics, Métis and non-Aboriginal urban household population aged 18 to 74, Canada excluding Quebec, 2006/2007 through 2008/2009**

Characteristics	Métis		Non-Aboriginal	
	Number	%	Number	%
<b>Hospitalized for ACSC</b>	400	1.0	20,300	0.7
<b>Age group</b>				
18 to 20	x	x	200	0.1
21 to 40	x	x	1,600	0.2
41 to 74	300	1.9	18,500	1.1
<b>Sex</b>				
Men	200	1.1	11,300	0.8
Women	200	1.0	9,000	0.6
<b>Province/Territory</b>				
Atlantic	x	x	2,500	1.1
Ontario	100	1.2	10,800	0.7
Manitoba	100	0.8	800	0.7
Saskatchewan	40	1.0	800	1.0
Alberta	100	1.2	2,200	0.6
British Columbia	60	1.0	3,200	0.6
Territories	x	x	40	0.7
<b>Statistical Area Classification Type</b>				
Census Metropolitan Area	200	0.9	12,300	0.6
Census Agglomeration (tracted)	30	1.2	1,300	1.0
Census Agglomeration (untracted)	80	1.2	3,100	1.1
Strong Metropolitan-Influenced Zone	10	0.8	1,200	1.0
Moderate Metropolitan-Influenced Zone	90	1.7	2,370	1.3
<b>Household income quintile</b>				
1 (lowest)	70	1.4	2,300	0.9
2	90	1.9	2,900	1.2
3	90	1.3	4,600	1.0
4	90	0.8	6,400	0.7
5	50	0.6	4,100	0.4
<b>Educational attainment</b>				
Less than secondary graduation	200	2.0	7,500	1.6
Secondary graduation or more	200	0.7	12,800	0.5
<b>Living arrangements</b>				
Alone	70	1.7	4,000	1.3
With others	300	1.0	16,300	0.6
<b>Labour force status</b>				
Not employed	20	0.8	500	0.4
Not in labour force	200	2.5	12,800	1.8
Employed	100	0.6	7,000	0.4

x suppressed to meet confidentiality requirements of *Statistics Act*

**Note:** Population counts rounded to the nearest 100; for two-digit figures, to the nearest tenth.

**Source:** Linked 2006 Census–2006/2007-to-2008/2009 Discharge Abstract Database.

**Table 4**  
**Age-standardized percentage hospitalized for ambulatory care sensitive condition, by type of comorbidity, Métis and non-Aboriginal urban household population aged 18 to 74, Canada excluding Quebec, 2006/2007 through 2008/2009**

Type of comorbidity	Métis		Non-Aboriginal	
	%		%	
At least two	4.5		3.8	
Diabetes with complications	5.0		4.4	
Diabetes without complications	1.7		1.5	
Congestive heart failure	1.7		1.8	
Chronic obstructive pulmonary disease	1.7		1.2	
Renal disease	1.5		1.5	
Peripheral vascular disease	1.3		0.9	
Myocardial infarction	1.2		1.2	
Mild liver disease	0.5		0.2	

**Source:** Linked 2006 Census–2006/2007-to-2008/2009 Discharge Abstract Database.

a COPD-related hospitalization or any kind of ACSC hospitalization were about 1.5 times higher.

## Discussion

At ages 18 to 74, Métis were significantly more likely than non-Aboriginal people to be hospitalized for an ACSC. Demographic, geographic, and socio-economic characteristics account for some, but not all, of these differences.

Restricting the cohort to residents of metropolitan or metropolitan influenced zones was an attempt to control for unmeasured effects of primary care (supply of physicians in urban areas). Residence within, rather than outside, a CMA was related to lower odds of ACSC hospitalization. A rising gradient in the distribution of ACSC hospitalization was evident across SAC Type from CMA to moderate metropolitan influence. However, area of residence did not fully account for differences in ACSC hospitalizations between the two groups. Métis may face barriers to primary health care similar to those reported by Aboriginal people generally.<sup>43-46</sup>

Adjustment for socioeconomic characteristics narrowed gaps between the two groups, but significant differences persisted. These differences may be due to risk factors such as daily smoking and poorer self-reported health, which are more prevalent among Métis,<sup>10,15,47</sup> but which were not available in the linked census–DAD data.

Results of the present analysis suggest a higher prevalence of serious comorbidities among Métis hospitalized with at least one ACSC. Such differences may partly explain the persistent association between ACSC hospitalization and Métis identity after all adjustments. Comorbidity among Métis ACSC patients suggests the existence of more serious illnesses, or that conditions compounded to complicate and further increase the likelihood of ACSC hospitalizations. This is consistent with research citing comorbidity as a possible explanation for the higher likelihood of hospitalization among Métis with diabetes relative to the overall population.<sup>21</sup>

Table 5

**Adjusted odds ratios relating Métis identity to hospitalization for any ambulatory care sensitive condition (ACSC), diabetes, or chronic obstructive pulmonary disease (COPD), urban household population aged 18 to 74, Canada excluding Quebec, 2006/2007 through 2008/2009**

Adjusted for:	Any ACSC			Diabetes			COPD		
	Odds ratio	95% confidence interval		Odds ratio	95% confidence interval		Odds ratio	95% confidence interval	
		from	to		from	to		from	to
Age, sex and province/territory	1.90*	1.71	2.10	2.35*	1.93	2.88	2.08*	1.73	2.51
Plus Statistical Area Classification Type	1.71*	1.54	1.89	2.16*	1.77	2.64	1.90*	1.58	2.28
Plus household income quintile	1.57*	1.41	1.74	1.98*	1.62	2.42	1.67*	1.39	2.01
Plus educational attainment	1.47*	1.33	1.63	1.87*	1.53	2.29	1.53*	1.27	1.84
Plus labour force status and living arrangements	1.46*	1.32	1.62	1.83*	1.50	2.24	1.52*	1.26	1.83

\*significantly different from non-Aboriginal population ( $p < 0.05$ )

**Note:** Reference is urban non-Aboriginal household population aged 18 to 74.

**Source:** Linked 2006 Census–2006/2007-to-2008/2009 Discharge Abstract Database.

## Conclusion

Métis living in CMAs or in CMA-influenced areas are more likely than non-Aboriginal adults in the same types of areas to experience ACSC hospitalizations. A higher prevalence of comorbid conditions among Métis may account for some of the difference, but this requires additional investigation. Research using other data sources is needed to assess the role of comorbid chronic conditions, primary health care access and use, and health behaviours in the association between Métis identity and the likelihood of ACSC hospitalization. ■



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***Hospitalization for ambulatory care sensitive conditions among urban Métis adults • Research Article***

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## Appendix

### Text Table A

#### International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada (ICD-10-CA) codes used to define ambulatory care sensitive conditions

Ambulatory care sensitive condition	Code range
Diabetes	E10, E11, E13, E14 AND none of: E109, E119, E139, E149
Chronic obstructive pulmonary disease	J41, J42, J43, J44, J47 AND chronic lower respiratory disease diagnosis (J41, J43, J44, J47)
Asthma	J45 and excluding records with any diagnosis code of cystic fibrosis and anomalies of the respiratory system
Angina	I20, I240, I248, I249, I2382, AND angina surgical exclusions (codes below) not present
Grand mal status and other epileptic convulsions	G40, G41
Heart failure and pulmonary edema	I50, J81
Hypertension	I100, I101, I11 AND hypertension exclusions (codes below) not present
<b>Exclusion qualifiers</b>	
Bronchitis with chronic lower respiratory disease	J40 with any of the following codes for diagnosed respiratory conditions: J41, J43, J44, J47
Diagnosed cystic fibrosis and anomalies of the respiratory system	E840, E84, E848, E8409, P270, P271, P278, P279, Q254, Q311, Q312, Q313, Q315, Q318, Q319, Q320, Q322, Q323, Q324, Q330, Q331, Q332, Q333, Q334, Q335, Q336, Q338, Q339, Q340, Q341, Q348, Q349, Q390, Q391, Q392, Q393, Q394, Q398, Q893
Heart hypertension exclusions	11J50, 1HZ85, 11J76, 1HB53 1HD53, 1HZ53, 1HB55, 1HD55, 1HZ55, 1HB54, 1HD54, 11J57GQ
Angina surgical intervention exclusions	First digit of surgical intervention code is 1 or 2 or 5

**Source:** Canadian Institute for Health Information. *Health Indicators 2013*. Ottawa: Canadian Institute for Health Information, 2013.

### Text Table B

#### ICD-10-CA codes used to define Charlson Index comorbidity

Comorbid condition	Code range
Myocardial infarction	I21, I22, I252
Congestive heart failure	I50, I43, I099, I110, I130, I132, I255, I420, I425, I426, I427, I428, I429
Peripheral vascular disease	I70, I71, I671, I731, I738, I739, I771, I790, I792, K551, K558, K559, Z958, Z959
Cerebrovascular disease	G45, G46, I60, I61, I62, I63, I64, I65, I66, I67, I68, I69, H340
Dementia	F00, F01, F02, F03, G30, F051, G311
Chronic obstructive pulmonary disease	J40, J41, J42, J43, J44, J45, J46, J47, J60, J61, J62, J63, J64, J65, J66, J67, I278, I279, J684, J701, J703
Connective tissue disease/Rheumatic disease	M05, M32, M33, M34, M06, M315, M351, M353, M360
Peptic ulcer disease	K25, K26, K27, K28
Mild liver disease	B18, K73, K74, K700, K701, K702, K703, K709, K717, K713, K714, K715, K760, K762, K763, K764, K768, K769, Z944
Diabetes without complications	E101, E106, E109, E110, E111, E116, E118, E119, E130, E131, E136, E138, E139, E140, E141, E146, E149
Diabetes with complications	E102, E103, E104, E105, E107, E112, E113, E114, E115, E117, E132, E133, E134, E135, E137, E142, E143, E144, E145, E147
Paraplegia and hemiplegia	G80, G81, G82, G041, G114, G830, G831, G832, G833, G834, G839
Renal disease	N18, N19, N052, N053, N054, N055, N056, N057, N250, I120, I131, N032, N033, N034, N035, N036, N037, Z490, Z491, Z492, Z940, Z992
Cancer	C0, C1, C6, C20, C21, C22, C23, C24, C25, C26, C30, C31, C32, C33, C34, C37, C38, C39, C40, C41, C43, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C70, C71, C72, C73, C74, C75, C76, C81, C82, C83, C84, C85, C88, C90, C91, C92, C93, C94, C95, C96, 'C97'
Moderate or severe liver disease	K704, K711, K721, K729, K765, K766, K767, I850, I859, I864, I982
Metastatic carcinoma	C77, C78, C79, C80
AIDS/HIV	B24

**Sources:** Quan H, Sundararajan V, Halfon P, et al. Coding algorithms for defining comorbidities in ICD-9-CM and ICD-10 administrative data. *Medical Care* 2005; 43(11): 1130-9; Canadian Institute for Health Information. International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada (ICD-10-CA). Ottawa: Canadian Institute for Health Information, 2006.