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Acute-care hospitalizations and Aboriginal identity in Canada, 2001/2002

by Gisèle Carrière, Rochelle Garner, Claudia Sanmartin, and LHAD Research Team

Health Information and Research Division
24-M, R.H. Coats Building, 100 Tunney's Pasture Driveway, Ottawa, K1A 0T6

Telephone: 1-800-263-1136

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Statistics Canada
Health Analysis Division
24-M R.H. Coats Building, 100 Tunney's Pasture Driveway, Ottawa K1A 0T6
Statistics Canada
Telephone number: 604-666-5907
Facsimile Number: 604-666-6680
Email: Gisele.Carriere@statcan.gc.ca

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About the Longitudinal Health and Administrative Data Initiative

The Longitudinal Health and Administrative Data (LHAD) Initiative is a partnership among provincial and territorial ministries of health and Statistics Canada, as well as the Canadian Institute for Health Information, the Canadian Council of Cancer Registries and the Vital Statistics Council for Canada. The objective of the Initiative is to address important information gaps by ensuring that key administrative data, such as those routinely collected through the health system, can be used to undertake pan-Canadian research to improve the understanding of relationships among risk factors, socio-economic characteristics, health status measures and health care utilization. The research involves the linking of provincial and territorial health administrative data within themselves, and with Statistics Canada population health survey data, the births and deaths databases, and the Canadian Cancer Registry. In addition to complementing the important record linkage research already being done within individual provinces, LHAD studies create invaluable opportunities to learn from comparisons among jurisdictions, as well as facilitate larger studies for less common types of events and conditions. In short, the LHAD Initiative is intended to establish the foundation for a Canadian record linkage program to help further the advancement of knowledge about health determinants, outcomes and their relationships.

Statistics Canada is the operational arm of the LHAD partnership. Two divisions within Statistics Canada - the Health Statistics Division (HSD) and the Health Analysis Division (HAD) collaborate in supporting the Initiative.

HSD is responsible for ongoing administrative support including organizing Steering Committee meetings and providing secretariat services to the Initiative. It is also responsible for building and maintaining the LHAD data processing environment, securely storing and processing LHAD datasets, and producing linked analysis files for all approved studies.

HAD provides research support to the LHAD program via the LHAD Research Team. HAD is the primary source of health research within Statistics Canada. Its mandate is to provide high quality, relevant and comprehensive information on the health status of the population and on the health care system. This project represents one of four research studies undertaken by the LHAD Research team from the research agenda developed by the LHAD Steering Committee in 2008.

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The analyses and conclusions in this report do not necessarily reflect those of the individual provincial representatives or their respective ministries of health.

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Executive summary

Health disparities between Aboriginal and non-Aboriginal populations in Canada, including differences in life expectancies, have clearly been established. A variety of sources is currently used to measure and document these disparities, yet information gaps persist. Because of limited coverage and sample sizes, reliable health information that reflects the diversity in Canada's Aboriginal population is not always available.

Hospital discharge records contain information about serious morbidity and include populations not regularly covered by national health surveys. However, Aboriginal identity information about patients is not recorded consistently across the country in hospital administrative data.

By assigning 2001 Census data for small geographical areas to hospital discharge records from the 2001/2002 Hospital Morbidity Database, this report provides estimates of morbidity serious enough to require hospitalization. Acute-care hospitalizations of people living in areas with a relatively high percentage of Aboriginal residents are compared with hospitalizations of residents of areas where the percentage of Aboriginal residents is low. Variations by predominant Aboriginal identity in these areas—First Nations, Métis and Inuit populations—are also explored.

Factors that potentially underlie differences in hospitalization rates between residents of high- and low-Aboriginal areas are determined by adjusting for urban/rural residence and area socio-economic characteristics.

Key findings

- Residents of areas with a relatively high percentage of Aboriginal people had significantly higher hospitalization rates, compared with residents of areas where the percentage of Aboriginal people was low.
- Hospitalizations of patients from areas with a high percentage of Aboriginal people had a significantly younger age distribution than did hospitalizations of patients from areas with a low percentage of Aboriginal people.
- The highest hospitalization rates were among residents of areas where the predominant Aboriginal identity was First Nations.
- Hospitalization rates for respiratory diseases, injuries and mental disorders were much higher among residents of areas with a high percentage of Aboriginal people.
- Urban/Rural location and housing conditions had the strongest associations with differences in hospitalization rates between residents of high- and low-Aboriginal areas.

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Introduction

Health disparities between Aboriginal and non-Aboriginal populations have been documented in Canada[1-7] and internationally,[8,9] the consequences of which include premature mortality among those with Aboriginal origins.[1,10-13] While efforts have been made to report health indicators that are comparable for Aboriginal and non-Aboriginal populations,[14] and indices of community well-being have been developed,[15] deficiencies in health surveillance for Aboriginal people persist.[2,16]

Survey data are often used to examine the health status of Aboriginal people, but because of limited coverage and small samples, information is rarely available by First Nations, Métis and Inuit identity. Studies tend to report pan-Aboriginal health characteristics, and thereby, may mask differences across Aboriginal groups. As well, the extent to which different health determinants contribute to health status may vary by Aboriginal identity group.

Hospital discharge records are indicators of serious morbidity and include populations not regularly covered by national health surveys. However, hospital records do not have consistent information on the Aboriginal identity of patients. Some jurisdictions have attempted to develop more comprehensive health surveillance for Aboriginal people using linked administrative records,[3,17] but employing those methods for analysis at the national level is currently not feasible.

This report combines 2001 Census data with hospital discharge records to compare hospitalization of residents of dissemination areas with a relatively high versus a low percentage of Aboriginal people[12] Hospitalization rates for high-Aboriginal dissemination areas are calculated by predominant Aboriginal identity: First Nations, Métis or Inuit.

While it is important to measure and document differences in hospitalization rates between Aboriginal and non-Aboriginal groups, it is equally important to understand factors associated with these differences. Socio-economic characteristics account, to some degree, for the higher prevalence of poor health in Aboriginal populations.[5] This analysis uses an ecological approach, based on the assumption that the social, cultural and environmental characteristics of a neighbourhood can influence health status.[18] The goal is to determine if the differences persist to a greater or lesser extent when both individual characteristics and area-level socio-economic conditions are taken into account.

Data sources

The data come from two sources: the 2001 Census of Canada and the 2001/2002 Hospital Morbidity Database (HMDB). The census data pertain to the characteristics of the population at the dissemination area (DA) level, the smallest geographic unit for which census data (including family, household and dwelling characteristics and Aboriginal identity) are available.

The HMDB, which is maintained by the Canadian Institute for Health Information, contains annual information about acute-care (as distinguished from long-term care) hospital discharges, including dates of admission and discharge, diagnoses and procedures, date of birth, sex, postal code, and health insurance number. Because Quebec does not submit complete postal code information, which was necessary for this analysis, Quebec data were excluded.

More details about these data sources are provided in Appendix B.

Methods

The term "Aboriginal" refers to people who identified as an Aboriginal person on the 2001 Census. Throughout this report, those who identified as North American Indian are referred to as First Nations. This analysis makes no distinction between Aboriginal people living on or off a reserve. The percentage of Aboriginal residents in a dissemination area (DA) is the number reporting Aboriginal identity divided by the DA's total population. DAs in which 33% or more of the population was Aboriginal were classified as "high-Aboriginal"; those with less than 33%, "low-Aboriginal."[12] Census information was also used to further classify each high-Aboriginal DA by predominant identity: First Nations, Métis or Inuit.

Because the Hospital Morbidity Database (HMDB) does not contain information about the Aboriginal identity, the percentage of the DA population that was Aboriginal was assigned to each hospital discharge record based on the patient's postal code, using the Postal Code Conversion File (PCCF+).[19]

Rural postal codes are often not uniquely matched to a single DA and may serve several DAs. The PCCF+ uses an unbiased procedure to assign a single postal code to a DA, after considering the weighted population counts for every DA that could possibly be selected. This could not be done for hospital discharge records for Quebec, which did not include 6-digit postal code information. The exclusion of Quebec meant that a considerable number of DAs with substantial Aboriginal populations were omitted from this analysis (*Limitations*). Table A in Appendix A displays the count of DAs to which the percentage of the population that was Aboriginal could not be assigned. Table C includes counts of hospitalizations excluded from the analysis because postal code information was incomplete or missing (n= 31,447, 1.5% of all records), or because the DA did not have sufficient census information to calculate the percentage of the population that was Aboriginal (n= 4,750, 0.22% of all included records).

In 2001, there were 52,993 DAs in Canada; 40,840 excluding Quebec. Of these, 2,066 (5.1% of included DAs) were classified as high-Aboriginal. High-/Low-Aboriginal could not be determined for 2,406 DAs (5.9% of all included DAs) because of very small counts for reported identity or missing information. The jurisdictions with the largest percentages of unclassifiable DAs were Newfoundland and Labrador, Yukon, Northwest Territories, and Saskatchewan. Together, the population in these unclassifiable DAs made up about 0.1% of the total population of Canada (Appendix A, Table B). Appendix A Table E lists incompletely enumerated Indian Reserves and Indian Settlements in the 2001 Census and corresponding population estimates.

Information about the characteristics of each dissemination area (DA) came from the 2001 Census. The prevalence of missing data for area characteristics is reported in Appendix A Table D.

DAs that were not located in Census Metropolitan Areas or Census Agglomerations (CMA/CA) and that had weighted populations less than 10,000 were designated ***rural***; otherwise, DAs were classified as ***urban***.

Area average household income quintile is based on summary data for neighbourhood (in the CMA/CA) income per person equivalent (IPPE), adjusted for household size. The PCCF+[19] classified DAs into an income quintile (Appendix C).

Labour force participation rate below jurisdiction rate is a dichotomous variable (yes/no) that indicates whether a DA's participation rate was below that of the province or territory. The labour force participation rate is the percentage of the population (aged 25 or older) who were employed or actively seeking work during the week before the 2001 Census.

Above-average percentage of population without secondary graduation is a dichotomous variable (yes/no) that indicates whether the percentage of the population aged 20 or older in a DA who did not complete secondary school was greater than the average for the province or territory.

20% or more private dwellings need major repair is a dichotomous variable (yes/no) that indicates whether 20% or more of private dwellings in the DA needed major repair.

10% or more private dwellings overcrowded is a dichotomous variable (yes/no) that indicates whether the ratio of people to rooms in at least 10% the private dwellings in the DA exceeded 1:1.

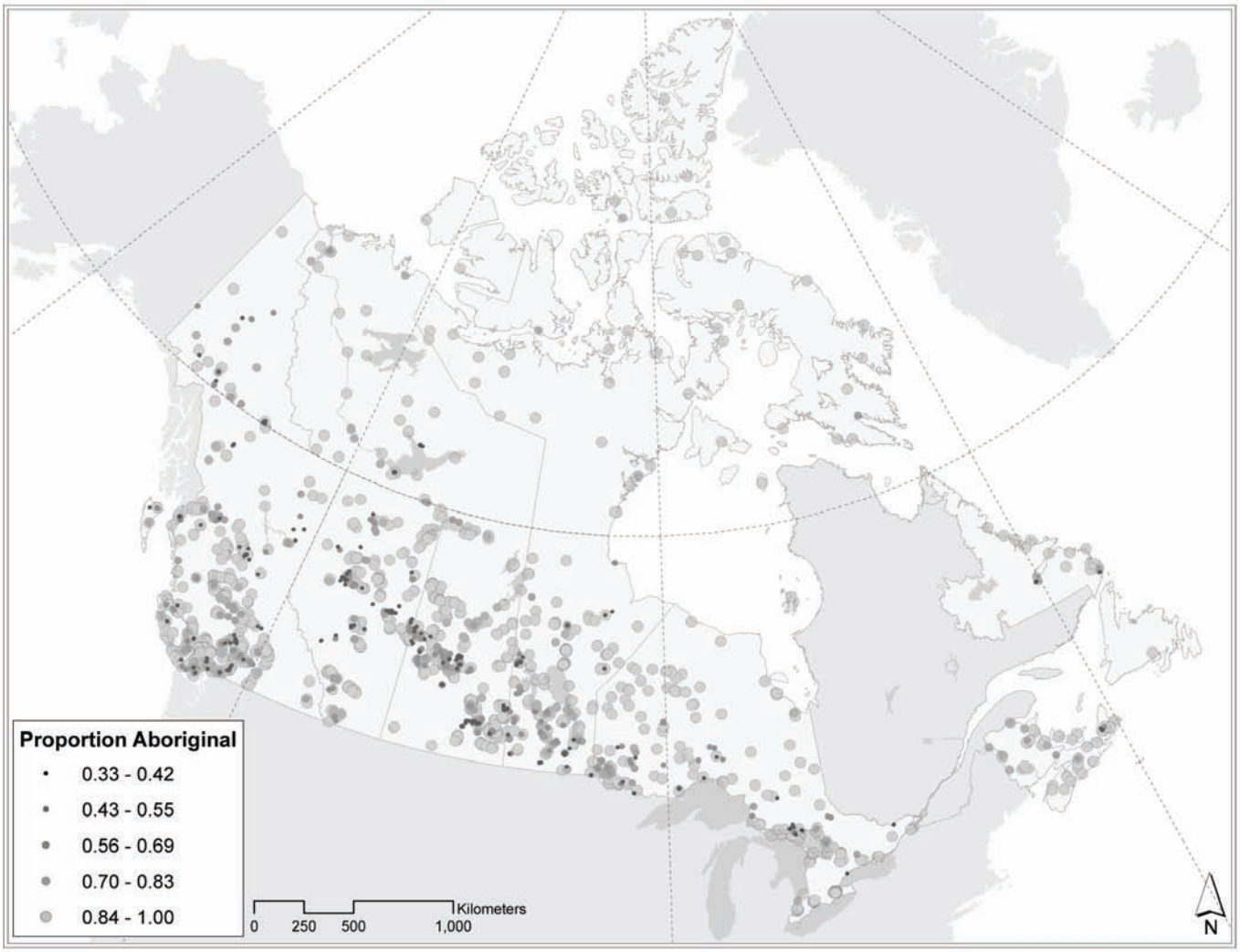
Findings

Distribution of dissemination areas by high-/low-Aboriginal classification

According to the 2001 Census, 2,066 dissemination areas (DAs) (5.1% of all DAs) were high-Aboriginal, that is, at least 33% of the population reported an Aboriginal identity (Appendix A, Table A). The percentage of Aboriginal people in these DAs ranged from 33% to 100% (Figure 1). The total population of these DAs was 471,130 (Appendix A, Table B).

The predominant Aboriginal identity was First Nations in 1,862 of these DAs; Métis in 135; and Inuit in 69. A quarter (25%) of the population in DAs with predominantly First Nations identity were in Manitoba, followed by Saskatchewan (23%), British Columbia (16%), Alberta and Ontario (each 13%) (data not shown). Saskatchewan (29%), Alberta (28%) and Manitoba (20%) had the largest percentages of the population in DAs with predominantly Métis identity . Predominant Inuit identity DAs were located primarily in Nunavut, with a smaller percentage in the Northwest Territories and Newfoundland and Labrador (Figures A, B and C).

Figure 1
Location of high† - Aboriginal dissemination areas, by percentage Aboriginal, Canada, 2001/2002



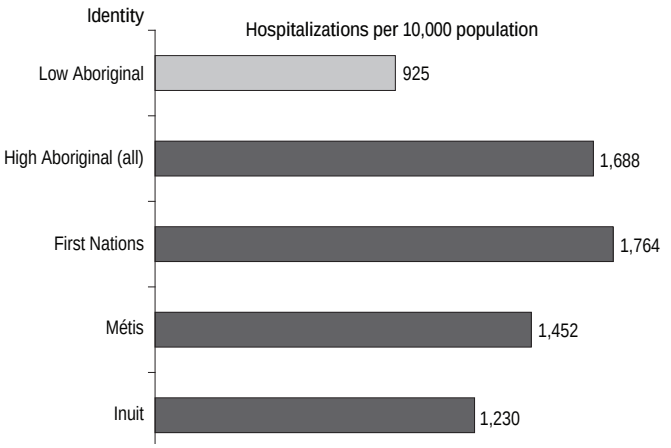
† 33% or more of total population reported Aboriginal identity on 2001 Census
Source: 2001 Census of Canada.

Hospitalization rates elevated

Hospitalization rates of residents of high-Aboriginal DAs were almost twice those of residents of low-Aboriginal DAs (Figure 2). Rates were highest for DAs where the predominant Aboriginal identity was First Nations: 1,764 hospitalizations per 10,000 population, compared with 925 for low-Aboriginal DAs. For DAs where the predominant identity was Métis, the rate per 10,000 was 1,452, and for predominantly Inuit DAs, 1,230.

Patients from high-Aboriginal DAs tended to be younger than those from low-Aboriginal DAs (Figure 3). The median age of patients from high-Aboriginal DAs was 36 years, compared with 53 years for patients from low-Aboriginal DAs. Patients' median age ranged from 26 years for those from predominantly Inuit DAs to 42 years for those from predominantly Métis DAs. These medians reflect the younger age profile of the Aboriginal population, attributable in part to higher fertility and premature mortality.

Figure 2
Unadjusted hospitalization rates of residents of high† - and low-Aboriginal dissemination areas, by predominant Aboriginal identity, Canada excluding Quebec, 2001/2002



† 33% or more of total population reported Aboriginal identity on 2001 Census

Note: Hospitalization counts were: low- Aboriginal dissemination areas = 2,059,462; high-Aboriginal dissemination areas overall = 79,567 (First Nations = 67,160; Métis = 8,157; Inuit = 4,250); area unclassifiable = 4,750.

Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

Differences greater when adjusted for age and sex

Given the young age profile of the Aboriginal population, and that serious morbidity requiring hospitalization is more likely at older ages, it is necessary to standardize hospitalization rates to remove the impact of these differences.

The age-/sex-standardized hospitalization rate for residents of high-Aboriginal DAs was more than twice that of residents of low-Aboriginal DAs (Figure 4). This difference could, in part, reflect the higher fertility rate of women in high-Aboriginal DAs. However, even when birth-related hospitalizations were excluded, differences in the standardized hospitalization rates persisted (Appendix A, Figure D). Rates were highest for predominantly First Nations DAs: 2,100 hospitalizations per 10,000 population, compared with 925 for low-Aboriginal DAs. In contrast to the crude rates, standardized hospitalization rates for predominantly Métis (1,676) and Inuit (1,677) DAs were almost the same.

Hospitalization rates for residents of high-Aboriginal DAs exceeded those for low-Aboriginal DAs in every province and territory (Figure 5). High-Aboriginal DA rates were highest in New Brunswick (2,914 hospitalizations per 10,000 population), followed by Alberta (2,747). At 827 hospitalizations per 10,000 population, Nunavut had the lowest rate for high-Aboriginal DAs (827).

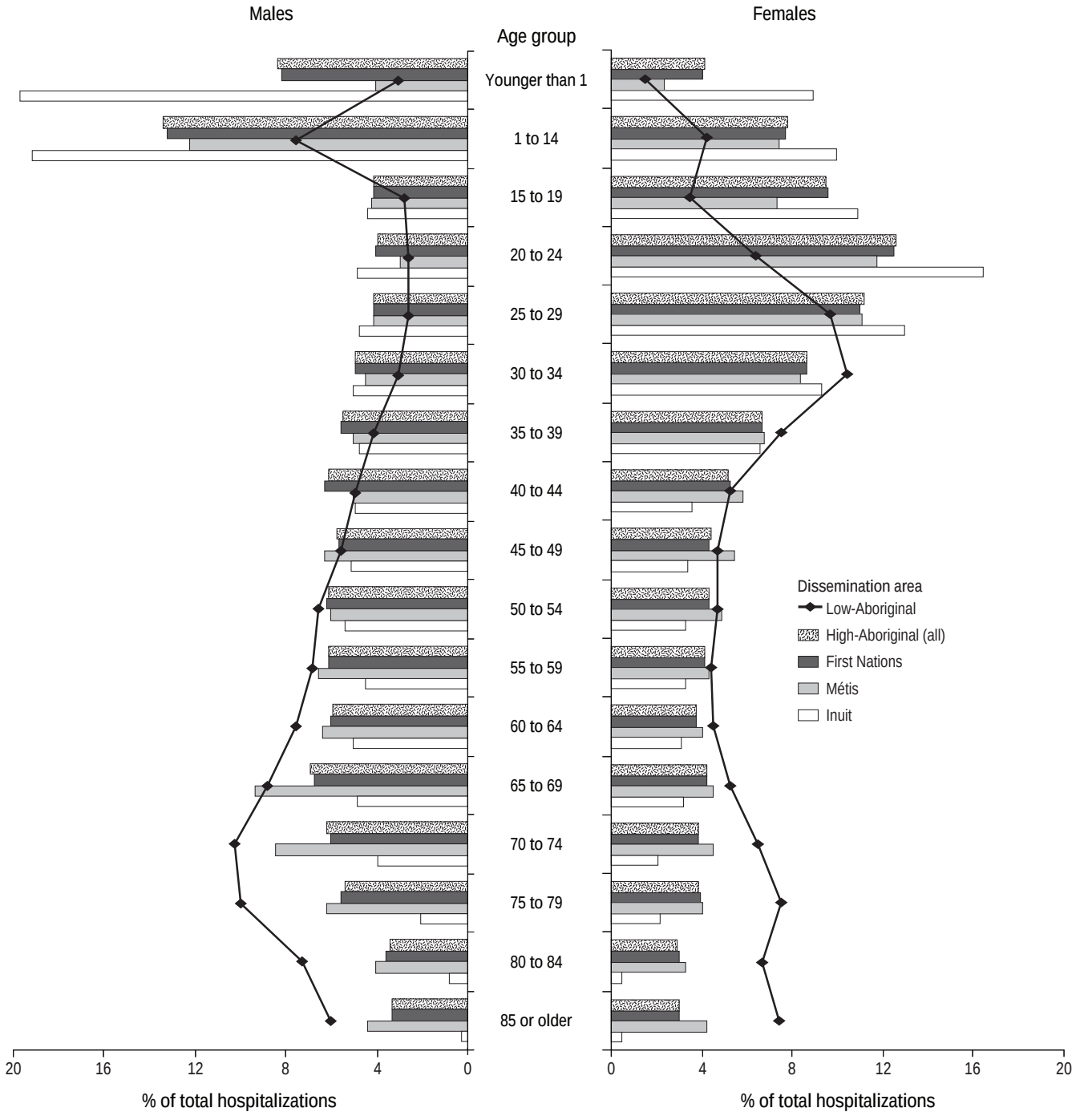
Rate ratios for high- versus low-Aboriginal DAs ranged from 1.3 in Yukon to 2.7 in Alberta (Table 1). High rate ratios in some provinces—for example, Alberta, and Ontario—may partly be because the predominant identity in many of these provinces' high-Aboriginal DAs was First Nations. Lower rate ratios may indicate that regional solutions have reduced disparities in serious morbidity between Aboriginal and non-Aboriginal populations, or conversely, a lack of access to care.

General disease groups

Among residents of high-Aboriginal DAs, age-/sex-standardized hospitalization rates for respiratory diseases were more than three times those of residents of low-Aboriginal DAs; rates for injuries, poisonings and consequences of other external causes were 2.6 times higher (Figure 6). Residents of high-Aboriginal DAs were just over twice as likely to be hospitalized for a mental health disorder and 1.8 times as likely to be admitted for a circulatory disease, compared with residents of low-Aboriginal DAs.

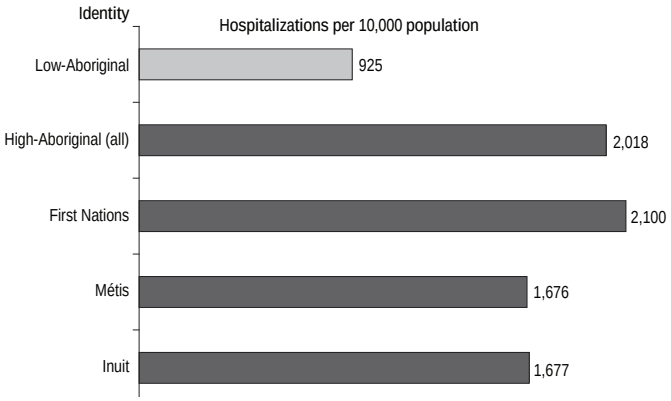
Residents of predominantly First Nations DAs had the highest hospitalization rates for all general disease groups

Figure 3
Age distribution of hospitalizations of residents of high† - and low-Aboriginal dissemination areas, by sex and predominant Aboriginal identity, Canada excluding Quebec, 2001/2002



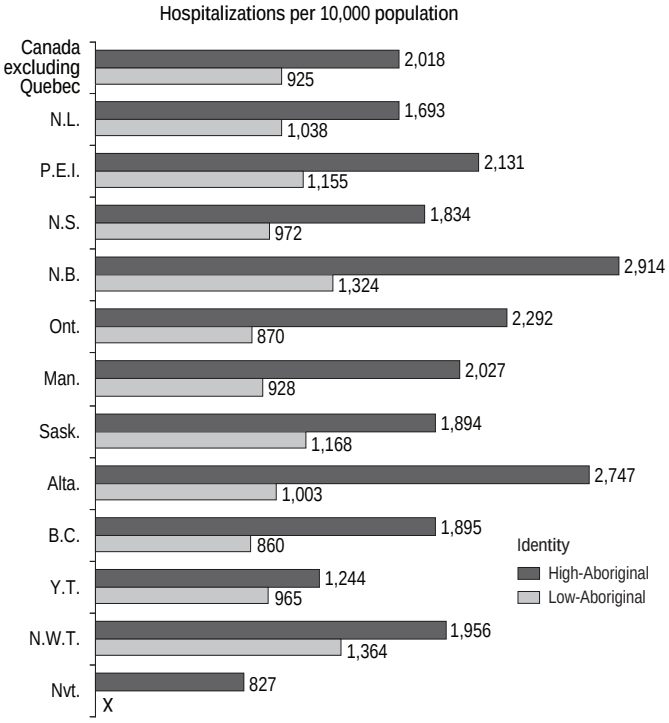
† 33% or more of total population reported Aboriginal identity on 2001 Census
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

Figure 4
Age-/Sex-standardized† hospitalization rates of residents of high‡- and low-Aboriginal dissemination areas, by predominant Aboriginal identity, Canada excluding Quebec, 2001/2002



† standardized to age and sex distribution of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
‡ 33% or more of total population reported Aboriginal identity on 2001 Census
Note: Acute-care hospitalization counts were: low-Aboriginal dissemination areas = 2,059,462; high-Aboriginal dissemination areas = 79,567 (First Nations = 67,160; Métis = 8,157; Inuit = 4,250); area unclassifiable = 4,750 (0.22% of all acute-care hospitalizations excluding Quebec for 2001/2002).
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

Figure 5
Age-/Sex-standardized† hospitalization rates of residents of high‡- and low- Aboriginal dissemination areas, by jurisdiction, Canada excluding Quebec, 2001/2002



† standardized to age and sex distribution of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
‡ 33% or more of total population reported Aboriginal identity on 2001 Census
x suppressed to meet confidentiality requirements of *Statistics Act*
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

Table 1
Age-/Sex- standardized† hospitalization rates, rate differences and relative rate ratios of residents of high‡- and low-Aboriginal dissemination areas, by jurisdiction, Canada excluding Quebec, 2001/2002

	Hospitalization rate (per 10,000 population)			Relative rate ratio (high/ low rate)
	High-Aboriginal	Low-Aboriginal	Difference	
Canada excluding Quebec	**2,018**	**925**	**1,093**	**2.2**
Newfoundland and Labrador	1,693	1,038	655	1.6
Prince Edward Island	2,131	1,155	976	1.8
Nova Scotia	1,834	972	862	1.9
New Brunswick	2,914	1,324	1590	2.2
Ontario	2,292	870	1422	2.6
Manitoba	2,027	928	1099	2.2
Saskatchewan	1,894	1,168	726	1.6
Alberta	2,747	1,003	1744	2.7
British Columbia	1,895	860	1035	2.2
Yukon	1,244	965	279	1.3
Northwest Territories	1,956	1,364	592	1.4
Nunavut	827	x	x	x

† standardized to age and sex distribution of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
‡ 33% or more of total population reported Aboriginal identity on 2001 Census
x suppressed to meet confidentiality requirements of *Statistics Act*
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

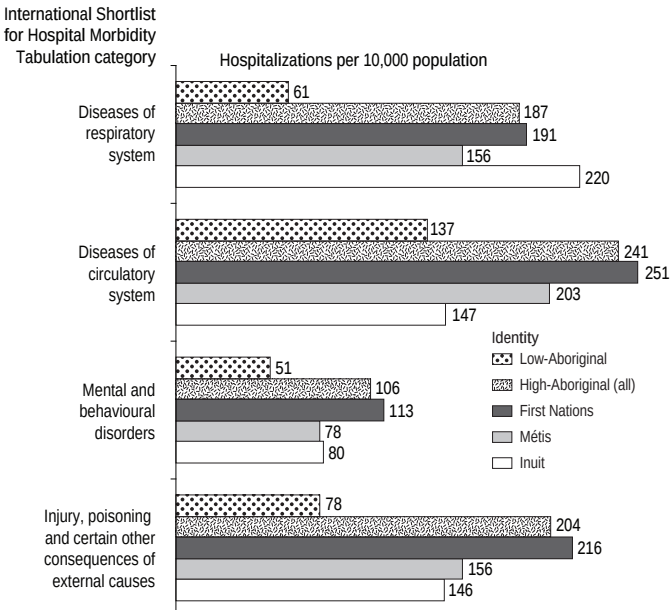
shown in Figure 6, except respiratory conditions, for which residents of predominantly Inuit DAs had the highest rates.

Specific diseases and conditions

Hospitalization rates were ranked to identify the ten most common causes. These rankings should be interpreted cautiously, because some are based on small numbers of hospitalizations and small differences in rank order. Those causes ranking high for residents of high-Aboriginal DAs were pneumonia, diabetes mellitus, acute bronchitis and bronchiolitis, cholelithiasis, and early or threatened labour (Table 2).

Pneumonia (organism unspecified) was the most common cause of hospitalization among residents of predominantly First Nations and Métis DAs; acute bronchitis/bronchiolitis

Figure 6
Age-/Sex-standardized† hospitalization rates of residents of high‡- and low-Aboriginal dissemination areas, by predominant Aboriginal identity and International Shortlist for Hospital Morbidity Tabulation heading category, Canada excluding Quebec, 2001/2002



† standardized to age and sex distribution of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
‡ 33% or more of total population reported Aboriginal identity on 2001 Census
§ hospitalizations having most responsible diagnosis code in each OECD International Shortlist for Hospital Morbidity Tabulation heading category; code ranges according to classification system listed in Appendix A, Table F
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

was the most frequent among residents of predominantly Inuit DAs. Diabetes mellitus ranked high as a cause of hospitalization for residents of First Nations and Métis DAs, but not Inuit DAs. The high ranking of poisoning caused by medication was unique to Inuit DAs.

Provincial/Territorial differences in the most common causes of hospitalization were evident (Table 3). Pneumonia ranked first among residents of high-Aboriginal DAs in Ontario and the Prairies, and second in British Columbia and the Northwest Territories. By contrast, for residents of low-Aboriginal DAs in these jurisdictions (except the Northwest Territories), pneumonia ranked fourth to ninth. Although Ontario, Manitoba and Alberta did not have any predominantly Inuit DAs, the high ranking of respiratory conditions in these

Table 2
Unadjusted top 10 frequency ranking of ICD-9 diagnosis† as most responsible cause of hospitalization, by predominant Aboriginal identity in high‡-Aboriginal dissemination areas, Canada excluding Quebec, 2001/2002

Identity and rank	Most responsible diagnosis at admission (ICD-9 code)	Hospitalizations	Rank in low-Aboriginal dissemination areas
High-Aboriginal (all)			
1	Pneumonia, organism unspecified (486)	2,592	4
2	Trauma to perineum and vulva during delivery (664)	2,077	1
3	Diabetes mellitus (250)	1,541	16
4	Acute bronchitis and bronchiolitis (466)	1,511	47
5	Cholelithiasis (574)	1,478	11
6	Other symptoms involving abdomen and pelvis (abdominal pain) (789)	1,390	15
7	Early or threatened labour (644)	1,297	25
8	Symptoms involving respiratory system and other chest symptoms (786)	1,285	6
9	Heart failure (including congestive heart failure/disease) (428)	1,258	3
10	Symptoms, signs, ill-defined conditions - general symptoms (780)	1,112	13
First Nations			
1	Pneumonia, organism unspecified (486)	2,198	4
2	Trauma to perineum and vulva during delivery (664)	1,689	1
3	Diabetes mellitus (250)	1,367	16
4	Cholelithiasis (574)	1,251	11
5	Other symptoms involving abdomen and pelvis (abdominal pain) (789)	1,193	15
6	Acute bronchitis and bronchiolitis (466)	1,157	47
7	Heart failure (including congestive heart failure/disease) (428)	1,102	3
7	Symptoms involving respiratory system and other chest symptoms (786)	1,102	6
9	Early or threatened labour (644)	1,066	25
10	Symptoms, signs, ill-defined conditions - general symptoms (780)	947	13
Métis			
1	Pneumonia, organism unspecified (486)	231	4
2	Trauma to perineum and vulva during delivery (664)	191	1
3	Diabetes mellitus (250)	168	16
4	Cholelithiasis (574)	166	11
5	Convalescence (V66)	152	34
6	Other symptoms involving abdomen and pelvis (abdominal pain) (789)	150	15
7	Symptoms involving respiratory system and other chest symptoms (786)	140	6
8	Heart failure (including congestive heart failure/disease) (428)	136	3
9	Early or threatened labour (644)	130	25
10	Skin and subcutaneous tissue - other cellulitis and abscess (682)	123	42
Inuit			
1	Acute bronchitis and bronchiolitis (466)	240	47
2	Trauma to perineum and vulva during delivery (664)	197	1
3	Pneumonia, organism unspecified (486)	163	4
4	Delivery in completely normal case (650)	108	28
5	Early or threatened labour (644)	101	25
6	Chronic bronchitis (491)	66	18
7	Hypertension complicating pregnancy, childbirth and puerperium (642)	65	54
8	Abnormality of forces of labour (661)	64	24
9	Cholelithiasis (574)	61	11
10	Poisoning by analgesics, antipyretics and antirheumatics (965)	54	127

† ICD-10-CA codes converted to ICD-9 codes for Newfoundland and Labrador, Prince Edward Island, Nova Scotia, British Columbia, Yukon Territory, as well as discharge records for most hospitals in Saskatchewan
‡ 33% or more of total population reported Aboriginal identity on 2001 Census
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

Table 3
Unadjusted top 5 frequency ranking of ICD-9 diagnosis[†] as most responsible cause of hospitalization in high[‡]-Aboriginal dissemination areas, by jurisdiction, Canada excluding Quebec, 2001/2002

Jurisdiction and rank	Most responsible diagnosis at admission (ICD-9 code)	Hospitalizations	Rank in low-Aboriginal dissemination areas
Newfoundland and Labrador			
1	Outcome of delivery on mother's record (V27)	129	18
2	Symptoms, signs, ill-defined conditions - general symptoms (780)	64	12
3	Cholelithiasis (574)	58	1
4	Other symptoms involving abdomen and pelvis (789)	54	7
5	Symptoms involving respiratory system and other chest symptoms (786)	52	10
Nova Scotia			
1	Symptoms involving respiratory system and other chest symptoms (786)	30	7
2	Other acute and sub-acute forms of ischemic heart disease (411)	x	4
3	Other and unspecified aftercare (V58)	x	5
3	Trauma to perineum and vulva during delivery (664)	x	1
5	Acute myocardial infarction (410)	x	2
New Brunswick			
1	Delivery in completely normal case (650)	38	21
2	Asthma (493)	36	19
3	Symptoms involving respiratory system and other chest symptoms (786)	34	1
3	Diabetes mellitus (250)	34	14
5	Acute bronchitis and bronchiolitis (466)	x	25
Ontario			
1	Pneumonia, organism unspecified (486)	375	5
2	Symptoms involving respiratory system and other chest symptoms (786)	236	6
3	Cholelithiasis (574)	220	13
4	Trauma to perineum and vulva during delivery (664)	204	1
5	Diabetes mellitus (250)	190	16
Manitoba			
1	Pneumonia, organism unspecified (486)	635	3
2	Trauma to perineum and vulva during delivery (664)	613	1
3	Delivery in completely normal case (650)	487	10
4	Early or threatened labour (644)	445	15
5	Other current conditions in mother classifiable elsewhere but complicating pregnancy, childbirth and puerperium (648)	402	55
Saskatchewan			
1	Pneumonia, organism unspecified (486)	489	5
2	Trauma to perineum and vulva during delivery (664)	385	6
3	Diabetes mellitus (250)	361	15
4	Cholelithiasis (574)	349	2
5	Heart failure (including congestive heart failure/disease) (428)	343	1
Alberta			
1	Pneumonia, organism unspecified (486)	607	4
2	Acute bronchitis and bronchiolitis (466)	420	44
3	Trauma to perineum and vulva during delivery (664)	395	1
4	Diabetes mellitus (250)	363	16
5	Early or threatened labour (644)	289	22
British Columbia			
1	Other symptoms involving abdomen and pelvis (789)	253	11
2	Pneumonia, organism unspecified (486)	195	9
3	Trauma to perineum and vulva during delivery (664)	174	1
4	Symptoms, signs, ill-defined conditions - general symptoms (780)	168	12
5	Cardiac dysrhythmias (427)	161	2
Northwest Territories[§]			
1	Diseases of hard tissue of teeth (521)	194	85
2	Pneumonia, organism unspecified (486)	167	2
3	Acute bronchitis and bronchiolitis (466)	161	25
4	Disorders of tooth development and eruption (520)	98	45
5	Trauma to perineum and vulva during delivery (664)	96	4
Nunavut			
1	Trauma to perineum and vulva during delivery (664)	116	X
2	Acute bronchitis and bronchiolitis (466)	106	X
3	Chronic bronchitis (491)	54	X
4	Delivery in completely normal case (650)	44	X
5	Early or threatened labour (644)	40	X

[†] ICD-10-CA codes converted to ICD-9 codes for Newfoundland and Labrador, Prince Edward Island, Nova Scotia, British Columbia, Yukon, as well as discharge records for most hospitals in Saskatchewan
[‡] 33% or more of total population reported Aboriginal identity on 2001 Census
[§] relative ranking for patients admitted from low-Aboriginal dissemination areas is shown, but frequency less than 30 in low-Aboriginal dissemination areas for ICD-9 code rows 521, 466, 520.
x suppressed to meet confidentiality requirements of *Statistics Act*
Notes: Total number of high-Aboriginal dissemination area hospitalizations for Prince Edward Island was 58, and for Yukon Territory, 592. For these two jurisdictions, diagnoses could not be ranked because of small counts (less than 30).
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

provinces may, in part, be because 1% to 3% of their total hospital discharges were out-of-province patients from Inuit identity DAs in other jurisdictions (Appendix A, Table C). Among residents of high-Aboriginal DAs in the Atlantic provinces, birth-related conditions and respiratory conditions were leading causes of hospitalization. For residents of high-Aboriginal DAs in the Northwest Territories, dental diseases and disorders and respiratory conditions were among the most common causes.

Hospitalization rates for conditions known to be highly prevalent among Aboriginal people (ischemic heart disease,[3,4,20,21] mental disorders,[5,22] and asthma[21,23,24]) and conditions associated with premature death such as specific types of injury, including suicide or homicide, were examined separately (Table 4). Hospitalization rates for intentional injury inflicted by others was nine times higher among residents of high- than of low-Aboriginal DAs. For intentional self-harm by means other than poisoning and for substance-abuse-related mental disorders, the rates were six times higher, and for self-harm by poisoning (for example, consumption of tranquilizers or barbiturates), four times higher (Table 4).

Hospitalization rates for acute bronchitis or bronchiolitis and for pneumonia and influenza were five and four times higher for residents of high- than of low-Aboriginal DAs, respectively. Rates for heart failure/pulmonary edema and asthma among residents of high-Aboriginal DAs were twice those for residents of low-Aboriginal DAs. Differences were narrower for acute myocardial infarction and ischemic heart disease. Reflecting the higher prevalence of HIV among Aboriginal people,[25] the rate for HIV was 1.4 times higher among residents of high- than of low-Aboriginal DAs. Differences were marginal for selected cancers, although cancer-related hospitalizations are likely underestimated (see *Limitations*).

Differences reduced by adjustment for area-level factors

Age-/Sex-standardization adjusts hospitalization rates for demographic differences in Aboriginal and non-Aboriginal populations. However, disparities between these populations' hospitalization rates likely result from differences in a much broader range of factors such as socio-economic status, employment and housing (Appendix A, Figure E).

In fact, when area-level characteristics were taken into account, disparities in hospitalization rates between high- and low-Aboriginal DAs were

Table 4
Unadjusted and age-/sex- standardized[†] hospitalization rates, for selected conditions,[‡] by residence in high[§]- and low-Aboriginal dissemination area, Canada excluding Quebec, 2001/2002

	Hospitalization rate per 10,000 population				
	Low-Aboriginal	High-Aboriginal			
	(crude) A	(crude) B	(standardized) C	Difference C-A	Relative rate ratio C/A
Intentional injury inflicted by others	3	27	27	24	9
Intentional self-harm by means other than poisoning	1	6	6	5	6
Intentional self-harm by poisoning	2	8	8	6	4
Substance abuse-related mental health disorders	7	33	38	31	6
Mood disorders	19	22	26	7	1
Acute bronchitis and bronchiolitis	5	32	24	19	5
Pneumonia and influenza	25	87	97	72	4
Asthma	9	18	17	8	2
Heart failure and pulmonary edema	20	28	49	29	2
Ischemic heart disease	59	54	84	25	1
Acute myocardial infarction	22	17	27	5	1
Cholelithiasis	14	31	38	24	3
Lung cancer[††]	6	5	9	3	1
Colorectal cancer[††]	7	5	9	2	1
Human immunodeficiency virus disease	0.5	0.7	0.7	0.2	1.4

[†] standardized to age and sex distribution of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
[‡] most responsible diagnosis; code ranges listed in Appendix A, Table F
[§] 33% or more of total population reported Aboriginal identity on 2001 Census
[††] excludes cancer admissions where most responsible diagnosis was chemotherapy treatment, because cancer is reported secondarily
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

lessened. Adjusting for rural location and the prevalence of housing in need of major repair in the DA lowered the hospitalization rate among residents of high-Aboriginal DAs (Table 5). Rural residence had the greatest impact, particularly in Inuit-identity DAs, where the adjusted rate ratio dropped to less than half that of low-Aboriginal DAs. By contrast, adjusting for housing conditions in predominantly Inuit DAs had the reverse effect, raising hospitalization rates.

For most of the selected conditions, adjusting for rural residence or the prevalence of housing in need of major repair had the greatest impact on hospitalization rates (Table 6). For example, hospitalization rates for injury and poisonings among residents of high-Aboriginal DAs fell from 204 per 10,000 population (rate ratio 2.6) to 178 (rate ratio 2.3) when adjusted for rural location, and to 174 (rate ratio 2.2) when adjusted for housing in need of major repair. Similarly, adjusting for these two factors reduced rate ratios for heart failure/pulmonary edema and pneumonia/influenza.

Adjusting for overcrowded housing lowered the hospitalization rate ratio, particularly for pneumonia/influenza (from 3.9 to 3.1) and for acute bronchitis/bronchiolitis (from 4.8 to 4.2). Adjusting for this characteristic modestly reduced the hospitalization rate ratio for heart failure/pulmonary edema (Table 6).

In general, adjusting for average DA household income quintile had relatively little impact on rate ratios; the greatest reduction was for pneumonia/influenza. And for asthma and acute bronchitis/

Table 5
Standardized[†] all-cause acute-care hospitalization rates and rate ratios[‡] per 10,000 population for residents of high[§]-Aboriginal areas, by predominant Aboriginal identity, Canada excluding Quebec, 2001/2002

	High-Aboriginal (all)		First Nations		Métis		Inuit	
	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio
Unadjusted	1,688	1.8	1,764	1.9	1,452	1.6	1,230	1.3
Age-/Sex- adjusted	2,018	2.2	2,100	2.3	1,676	1.8	1,677	1.8
Adjusted for sex, age and following area characteristics:								
Rural	1,675	1.8	1,735	1.9	1,364	1.5	329	0.4
Area average household income quintile	1,884	2.0	1,974	2.1	1,689	1.8	1,784	1.9
Labour force participation below jurisdiction rate	1,930	2.1	2,014	2.2	1,676	1.8	1,706	1.8
Above-average (jurisdiction) percentage of population aged 20 or older without secondary graduation	1,966	2.1	2,052	2.2	1,693	1.8	1,658	1.8
10% or more private dwellings overcrowded	1,830	2.0	1,892	2.0	1,585	1.7	2,002	2.2
20% or more private dwellings need major repair	1,694	1.8	1,736	1.9	1,567	1.7	1,909	2.1

[†] standardized to distributions for sex, age and each area characteristic of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
[‡] rate ratio denominators are all-cause hospitalization rate of 925 per 10,000 for residents of low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
[§] 33% or more of total population reported Aboriginal identity on 2001 Census
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

Limitations

Predominant identity refers to the most prevalent (First Nations, Métis or Inuit) among all reported Aboriginal identities that comprised at least 1% of the total population in a high-Aboriginal DA. Predominant identity does not mean that 33% or more of the DA's population was, for example, First Nations; the correct interpretation is that 33% or more of the total population of the DA was Aboriginal, among whom the most prevalent identity was First Nations. Moreover, within predominant Aboriginal identity groups, distinct cultures and identities exist.

To designate a DA as "high-Aboriginal," this analysis selected a threshold of 33% or more of the population reporting Aboriginal identity. However, this threshold does not necessarily apply to "predominant Aboriginal identity." Because Inuit are concentrated in distinct geographic areas, the 33% threshold yields DAs in which more than 80% of the population was Inuit, and which together accounted for more than 80% of the Inuit population.[26] By contrast, the Métis are not geographically concentrated, so high-Aboriginal DAs in which Métis are the predominant identity yield DAs in which a much smaller percentage of the population was Métis and accounted for 50% of all Métis in Canada.[26]

In 2001, census enumeration was not permitted or was interrupted before it could be completed on 30 Indian reserves and settlements, representing an estimated 34,541 individuals (Appendix A, Table E). Furthermore, the census does not collect Aboriginal identity information from people living in collective dwellings. Therefore, acute-care hospitalizations for high-Aboriginal DAs are likely underestimated.

The results of this study might have been different had it been possible to include Quebec. In 2001, around 79,000 Quebec residents self-identified as Aboriginal, representing about 8% of all people who did so (close to one-tenth of the total Aboriginal population).

This analysis pertains only to acute-care hospitalizations; other hospitalizations are not included. For example, Aboriginal populations have been shown to be disproportionately represented among psychiatric hospitalizations in Ontario.[22]

Hospitalization rates for specific conditions were based on the "most responsible diagnosis" (MRDX) on each record. As a result of using the MRDX, hospitalizations of cancer patients were not counted where the most responsible diagnosis was chemotherapy treatment; therefore, rates under-represent total hospitalized cancer cases.

In 2001/2002, implementation of the 10th revision to the *International Classification of Diseases* (ICD-10) was underway but not complete (Appendix A, Tables F and G; Appendix B). At that time, Canadian hospitals were using one of three classification systems to code their data. For some analyses in this report, codes were converted to the ICD-9 system. This may have produced slight over- or undercounts of some diseases ranked in Tables 2 and 3 for some jurisdictions. Although coding was done with the assistance of a coding expert and in accordance with international standards, acute myocardial infarction rates may be undercounted for hospitals that used the ICD-10 system, because of different coding systems reflecting shorter timing of onset of the condition.

This report used only univariate analytical techniques. Hierarchical multivariate modeling to simultaneously adjust for both patient-level and area-level factors might have produced different results.

Values were assigned to the dichotomous area-level variables in relation to either DA or provincial/territorial benchmarks. This may have strengthened or weakened the association between any given variable and hospitalization rates, compared with what would have been the case if a national benchmark had been used.

Table 6
Standardized[†] hospitalization rates per 10,000 population and rate ratios for selected conditions,[‡] residents of high[§]- and low-Aboriginal dissemination areas, by selected characteristics, Canada excluding Quebec, 2001/2002

	Injury/ Poisoning[††]		Mental/ Behavioural disorders[††]		Heart failure/ Pulmonary edema		Ischemic heart disease		Acute myocardial infarction		Pneumonia/ Influenza		Acute bronchitis/ Bronchiolitis		Asthma	
	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio
Low-Aboriginal	78	...	51	...	20	...	59	...	22	...	25	...	5	...	9	...
High-Aboriginal																
Unadjusted	181	2.3	93	1.8	28	1.4	54	.9	17	.8	87	3.5	32	6.4	18	2.0
Age-/Sex- adjusted	204	2.6	106	2.1	49	2.5	84	1.4	27	1.2	97	3.9	24	4.8	17	1.9
Adjusted for sex, age and following area characteristics:																
Rural	178	2.3	103	2.0	40	2.0	79	1.3	27	1.2	66	2.6	17	3.4	16	1.8
Area average household income quintile	188	2.4	97	1.9	44	2.2	76	1.3	25	1.1	85	3.4	25	5.0	17	1.9
Labour force participation below jurisdiction rate	193	2.5	100	2.0	48	2.4	80	1.4	26	1.2	90	3.6	22	5.0	16	1.8
Above-average (jurisdiction) percentage of population aged 20 or older without secondary graduation	198	2.5	102	2.0	48	2.4	82	1.4	26	1.2	96	3.8	24	4.8	17	1.9
10% or more private dwellings overcrowded	188	2.4	105	2.1	42	2.1	76	1.3	25	1.1	78	3.1	21	4.2	17	1.9
20% or more private dwellings need major repair	174	2.2	99	1.9	36	1.8	69	1.2	24	1.1	70	2.8	22	4.4	16	1.8

[†] standardized to distributions for age and sex and each dissemination area characteristic of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
[‡] selected using most responsible diagnosis for hospital admission
[§] 33% or more of total population reported Aboriginal identity on 2001 Census
[††] most responsible diagnosis code included in OECD International Shortlist for Hospital Morbidity Tabulation heading category *Injury, poisoning and certain other consequences of external causes*; code ranges listed in Appendix A, Table F
[‡‡] hospitalizations having most responsible diagnosis code included in OECD International Shortlist for Hospital Morbidity Tabulation heading category *Mental and behavioural disorders*; code ranges listed in Appendix A, Table F
... not applicable
Note: Rate ratios are in relation to "Low-Aboriginal."
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

bronchiolitis, adjusting for household income had the reverse effect, slightly increasing the rate ratio.

Adjusting for DA labour force participation and educational attainment resulted in modest or no change to the rate ratios across all selected disease categories.

Discussion and conclusions

Health disparities between Aboriginal and non-Aboriginal populations in Canada have been extensively documented.[2-7,21] This report provides new information about variations in serious morbidity, as measured by acute-care hospitalization, among residents of high- and low-Aboriginal DAs, and by predominant Aboriginal identity.

Survey data provide estimates of disease prevalence but not severity or progression. Self-reported survey data may also introduce recall bias and be limited by respondents' ability to accurately describe medical conditions. On the other hand, by definition, acute-care hospitalization indicates relatively severe morbidity. Hospital administrative data may contain more accurate medical information and can give more specifics about the types of morbidity that contribute to the differences in hospitalization rates between residents of high- and low-Aboriginal DAs.

The results of this analysis are consistent with information reported for First Nations or Registered Indian populations using regional hospital discharge data,[3,21] other health service administrative data,[20] and international evidence.[8]

The differences in hospitalization rates were greater when standardized by sex and age. This suggests that residents of high-Aboriginal DAs were more likely to experience serious injury and illness at younger ages. The higher hospitalization rate for injury among residents of high-Aboriginal DAs reflects the greater prevalence of serious injury among the off-reserve Aboriginal population.[6] Higher hospitalization rates for self- and other harm mirror the ranking of such injuries among the leading causes of premature mortality in high-Aboriginal health regions.[12]

Similarly, higher hospitalization rates for circulatory conditions are consistent with the ranking of circulatory diseases as the third leading cause of death in high-Aboriginal health regions.[12] The elevated hospitalization rates may be the outcome of inter-relationships between different diseases over an individual's life. Pneumonia can be a factor in the development of circulatory disease,[27] as can diabetes and hypertension. These circulatory conditions are widely prevalent in the Aboriginal population.[5,23,24,28-30] As well, poor oral health can place individuals at risk for heart disease-related morbidity later in life.[31,32] And to some extent, higher hospitalization rates for circulatory diseases and respiratory conditions may reflect the higher prevalence of smoking,[5,23,24] higher caloric intake,[34] and overweight and obesity,[34,35] in the Aboriginal population.

Relatively low immunization rates among some Aboriginal populations[36] may contribute to higher hospitalization rates for respiratory illnesses. However, the analysis in this report suggests that housing conditions are also relevant. Overcrowding and homes in need of major repair[23] may be conducive to the spread of infectious disease and lead to higher rates of respiratory-related hospitalizations.[37-40]

Hospitalization rates varied by DA predominant Aboriginal identity. Rates for residents of predominantly Inuit DAs were lower than those for residents of predominantly First Nations DAs. Several factors may play a role in this difference. The diet of Inuit adults still consists largely of meat and harvested fish1[23] — foods that could have protective health benefits. Inuit may be more likely to travel outside their jurisdiction for acute-care hospitalization, which may result in longer hospital stays. By contrast, residents of less remote high-Aboriginal DAs may "cycle" through hospitals more frequently with shorter stays. It is possible that residents of predominantly Inuit DAs do not have the same degree of access to health services as residents of other high-Aboriginal DAs. The lower hospitalization rates for residents of predominantly Inuit DAs may indicate less access to care, which results in death rather than hospitalization. This possibility could be evaluated in the future with a person-level analysis examining length of hospital stay and hospital distance from the patient's residence. The increase in hospitalization rates for residents of predominantly Inuit DAs that results from adjusting for housing conditions underscores the potential role of these factors in hospitalized morbidity of the Inuit.

Hospitalization rates were also lower among residents of predominantly Métis DAs, compared with predominantly First Nations DAs. This may be, in part, because nearly 70% of the Métis population lives in urban centres,[24] and therefore, may have more access to primary health care services than residents of First Nations DAs.

This report sought to disentangle the relative contribution of socio-economic and geographic factors to differences in hospitalization rates between high- and low-Aboriginal DAs. The selected area factors vary in the degree in which they are associated with hospitalization rates, although rural location and overcrowded housing appear to have the strongest relationships, in particular, for First Nations and Inuit DAs and for those with respiratory-related hospitalizations.

It is less obvious how housing conditions could be involved in cardiac morbidity. Overcrowding may increase the risk of infectious diseases, which, in turn, could affect cardiac health.[41] Housing in need of major repair could contribute to exposure to cold, which may play a role in cardiac pathogenesis.[42]

The significant association between rural location and hospitalization may be partially because rural residents are generally at greater risk of injury,[43] for example, travelling greater distances in motor vehicles. Rural residence may also be a proxy for difficulties accessing preventive primary health care.[44] Lastly, smoking, obesity and a sedentary lifestyle,

which are risk factors for cardiac and respiratory morbidity, are more prevalent among rural residents.[45]

The differences in hospitalization rates between high- and low-Aboriginal DAs are not much reduced when adjusted for average area household income, educational attainment and labour force participation. This underlines the limitations of an ecological approach, given the well-established gradients in health status by such determinants at the individual level. Area-level variables can play a role in morbidity, but they are not as direct an influence as person-level factors like smoking.

Hospitalization rates for DAs with a high percentage of Aboriginal residents, in particular, First Nations, were higher nationally and across jurisdictions. This could signal a need for preventive health care, a lack of access to care, or a greater prevalence of serious morbidity. These high rates also indicate candidate areas and health conditions for targeted interventions, that might eventually reduce disparities in premature mortality between Aboriginal and non-Aboriginal people.

The area characteristic standardization analysis identifies modifiable factors, specifically housing conditions, associated with differences in hospitalization rates. However, adjusting for area household income, educational attainment and labour force participation did not reduce hospitalization rate differences between high- and low-Aboriginal DAs to the same extent as adjusting for rural locale and housing conditions.

While this report attempts to address existing data gaps, it is based on area-level data. Whether individuals from high-Aboriginal DAs are at greater risk of hospitalization than are people from low-Aboriginal DAs cannot be definitively answered without person-level hospitalization counts that contain information on Aboriginal identity.

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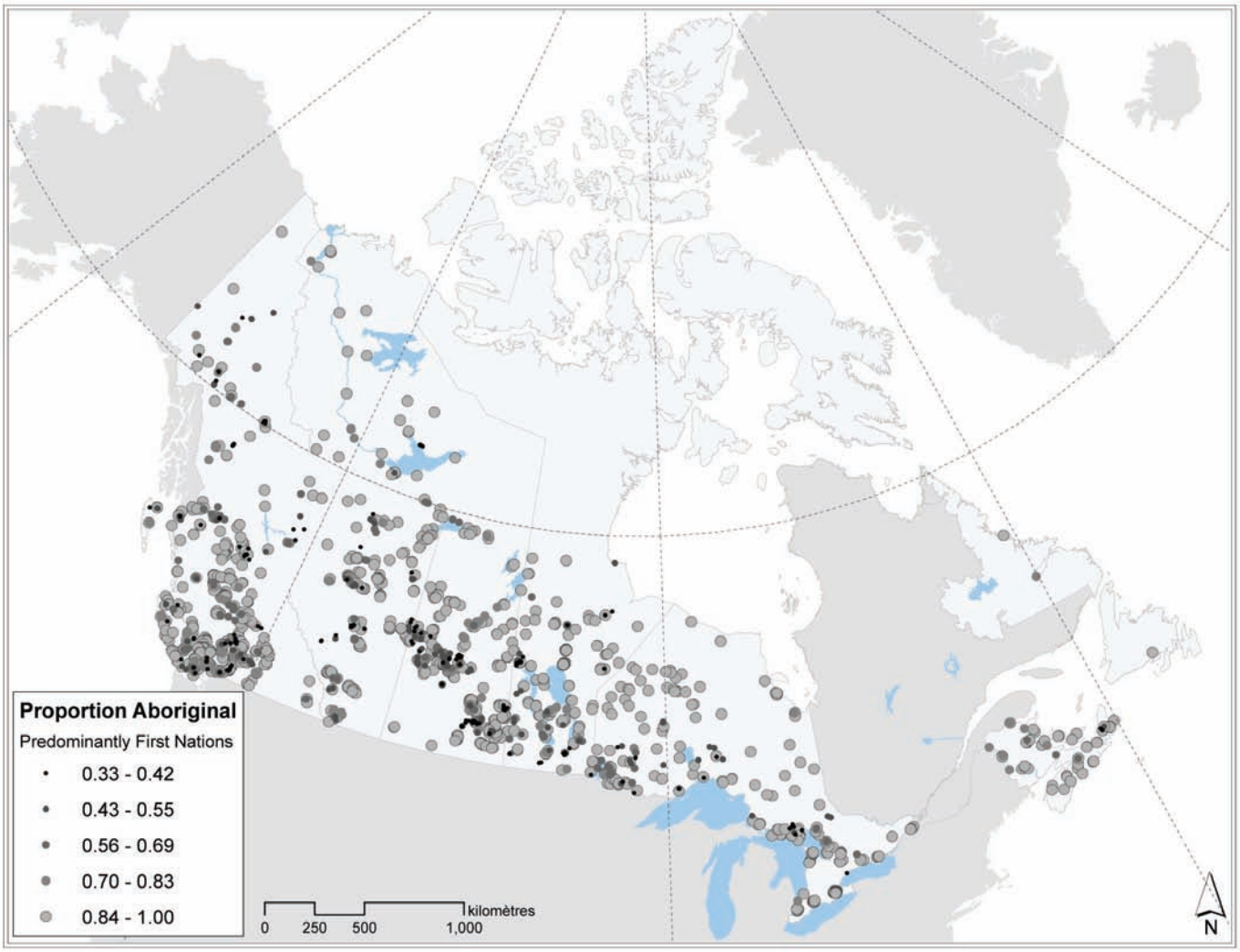
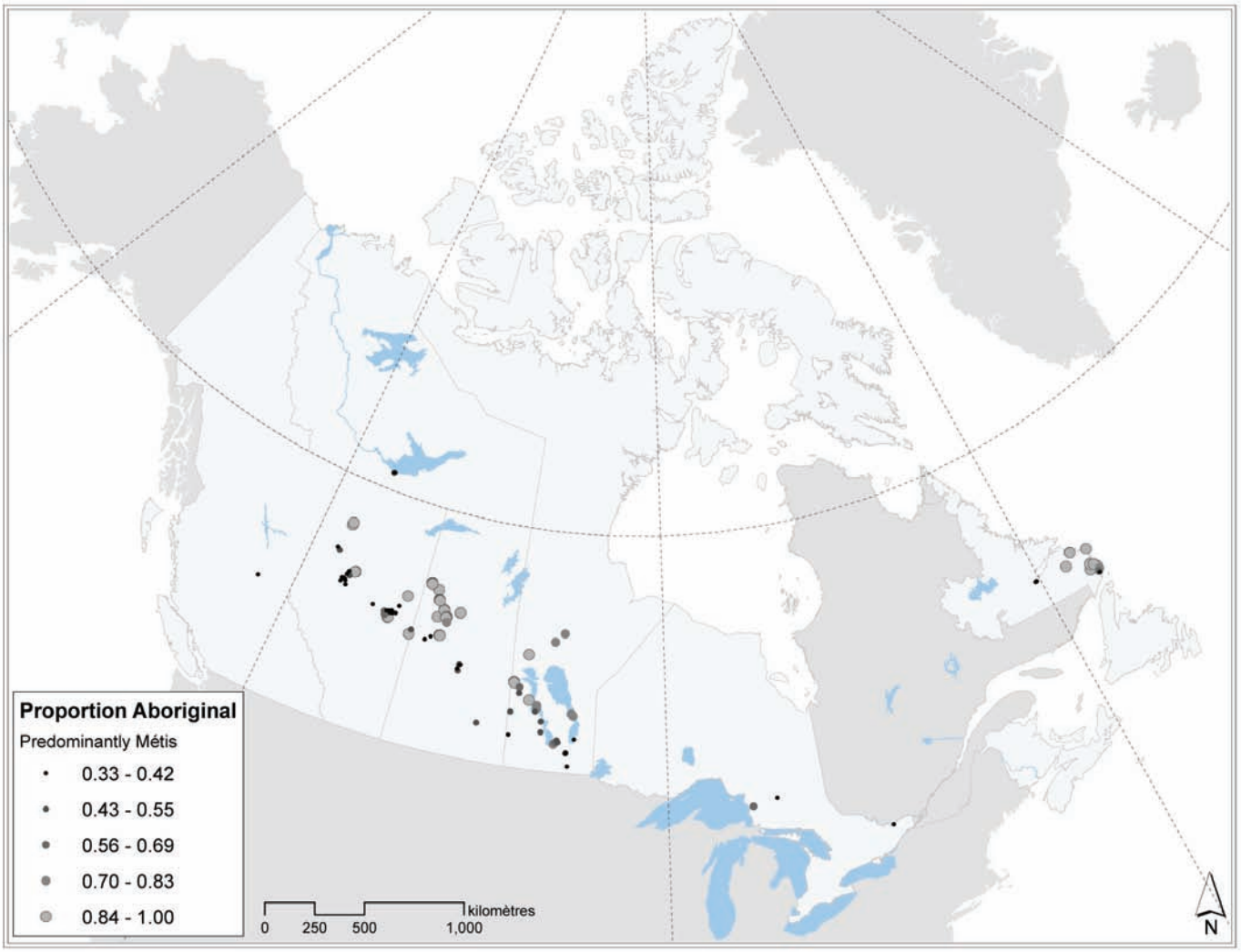
Appendix A

Figure A
Distribution of high[1]-Aboriginal predominantly First Nations dissemination areas, by proportion Aboriginal, Canada, 2001/2002



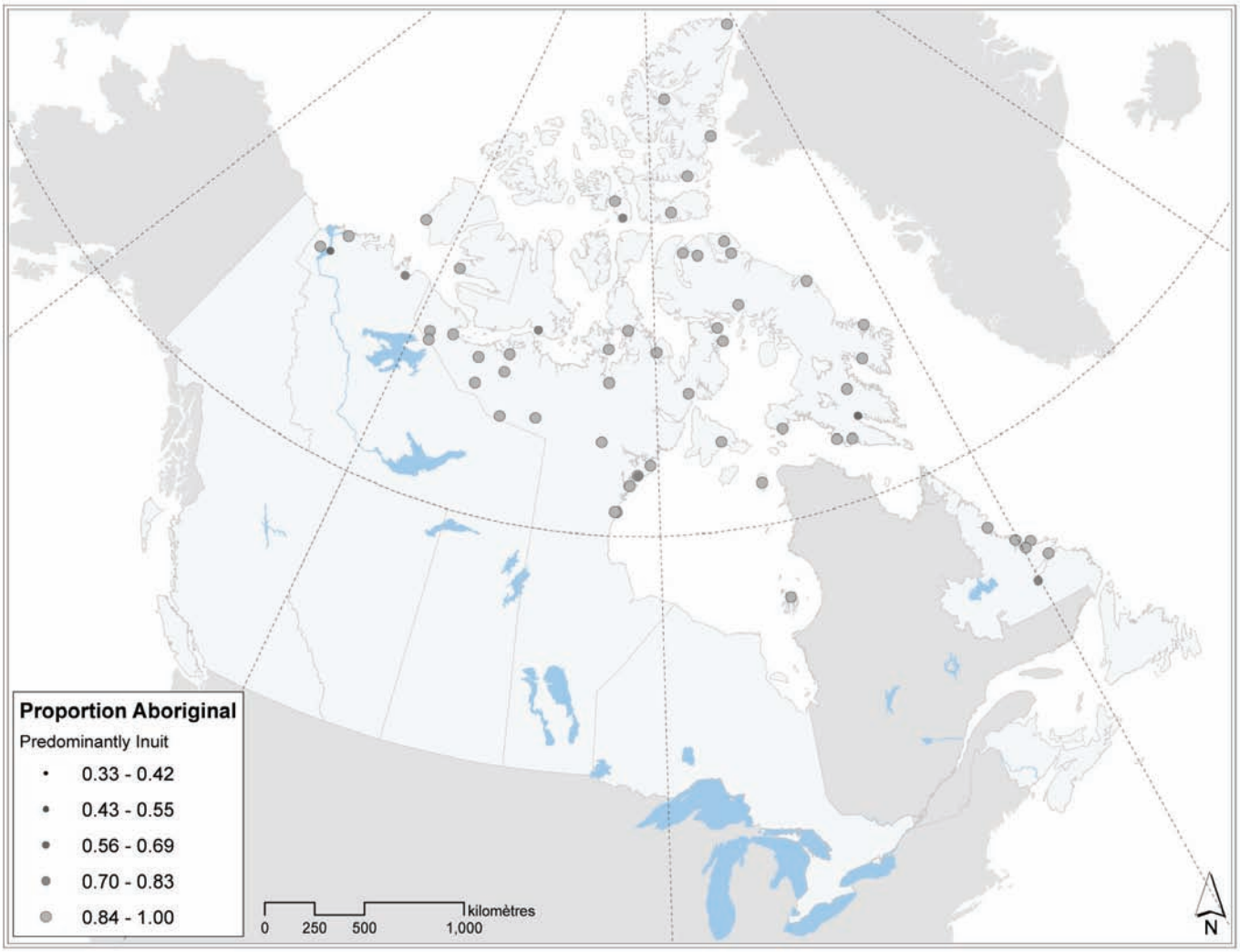
[1] 33% or more of total population reported Aboriginal identity on 2001 Census
Source: 2001 Census of Canada.

Figure B
Distribution of high[1]-Aboriginal predominantly Métis dissemination areas, by proportional Aboriginal, Canada, 2001/2002



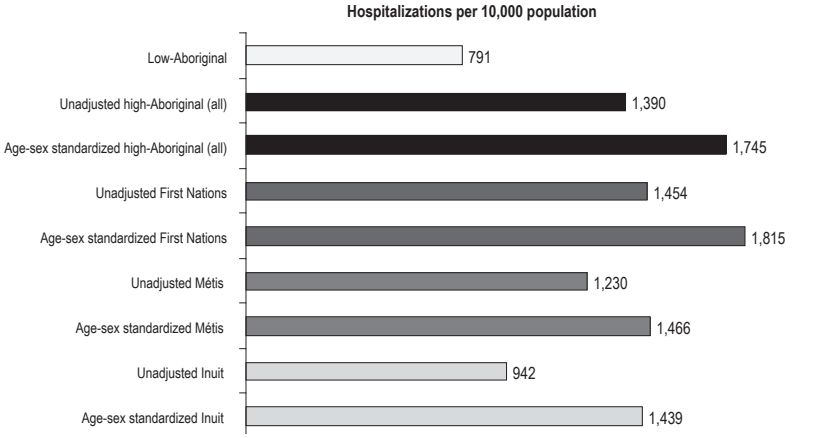
[1] 33% or more of total population reported Aboriginal identity on 2001 Census
Source: 2001 Census of Canada.

Figure C
Proportion of high[1]-Aboriginal predominantly Inuit dissemination areas, by proportional Aboriginal, Canada, 2001/2002



[1] 33% or more of total population reported Aboriginal identity on 2001 Census
Source: 2001 Census of Canada.

Figure D
Hospitalization rates[†] (with suppressions[‡]) of residents of high[§]- and low-Aboriginal dissemination areas, by predominant Aboriginal identity, Canada excluding Quebec, 2001/2002



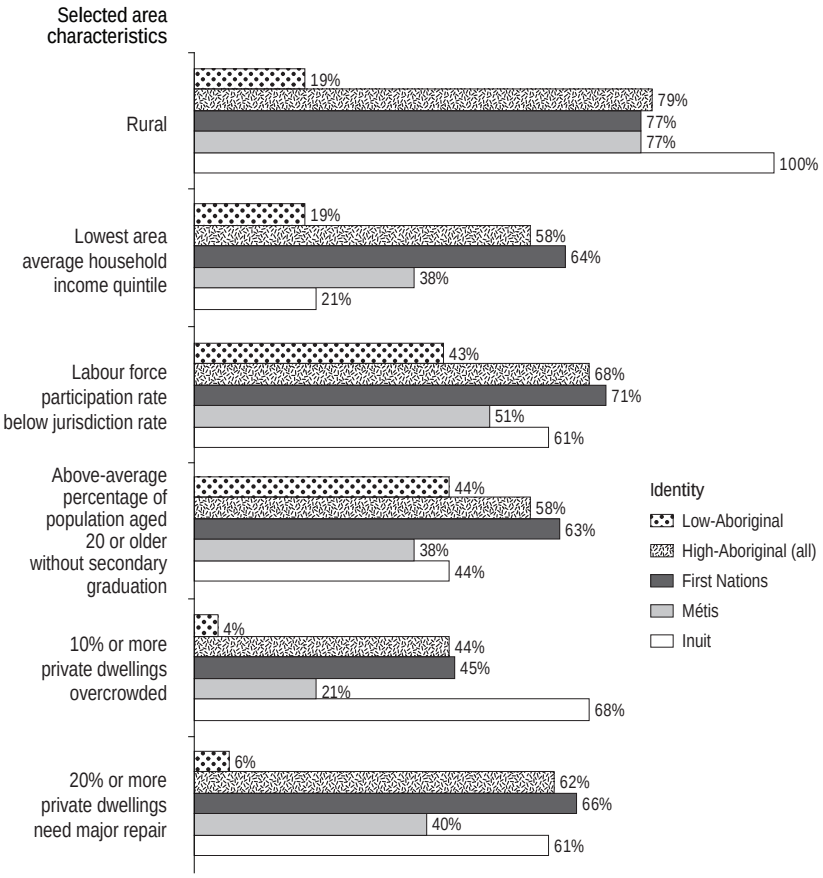
[†] standardized to sex and age distribution of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001

[‡] pregnancy and birth-related hospitalizations excluded from rate calculations; suppressions include hospitalizations having most responsible diagnoses code in OECD International Shortlist for Hospital Morbidity Tabulation (ISHMT) heading category "Pregnancy, childbirth and the puerperium" in addition to some codes in ICD-10 section "Persons encountering health services in circumstances related to reproduction"; code ranges for suppressions listed according to classification system in Appendix A, Table F

[§] 33% or more of total population reported Aboriginal identity on 2001 Census

Sources: 2001/2002 Hospital Morbidity Database; 2001 Census.

Figure E
Percentage of population living in high[†]- and low-Aboriginal dissemination areas, by predominant Aboriginal identity and selected area characteristics, Canada excluding Quebec, 2001/2002



[†] 33% or more of total population reported Aboriginal identity on 2001 Census
Source: 2001 Census of Canada.

Table A
Distribution of 2001 dissemination areas, by high[†]- and low-Aboriginal classification, predominant Aboriginal identity and jurisdiction, Canada, 2001

	Total dissemination areas	Low-Aboriginal		High-Aboriginal (all)		First Nations		Métis		Inuit		% Aboriginal unclassifiable	
	Number	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Canada	52,993	47,914	90.4	2,210	4.0	1,981	4.0	136	0.3	93	0.2	2,869	5.0
Canada excluding Quebec	**40,840**	**36,368**	**89.1**	**2,066**	**5.1**	**1,862**	**4.6**	**135**	**0.3**	**69**	**0.2**	**2,406**	**5.9**
Newfoundland and Labrador	1,231	901	73.2	27	2.2	4	0.3	17	1.4	6	0.5	303	24.6
Prince Edward Island	225	209	92.9	4	1.8	4	1.8	0	0.0	0	0.0	12	5.3
Nova Scotia	1,397	1,273	91.1	34	2.4	34	2.4	0	0.0	0	0.0	90	6.4
New Brunswick	1,349	1,204	89.3	31	2.3	31	2.3	0	0.0	0	0.0	114	8.5
Quebec	12,153	11,546	95.0	144	1.2	119	1.0	1	0.0	24	0.2	463	3.8
Ontario	18,596	17,716	95.3	271	1.5	268	1.4	3	0.0	0	0.0	609	3.3
Manitoba	2,235	1,815	81.2	249	11.1	215	9.6	34	1.5	0	0.0	171	7.7
Saskatchewan	2,937	2,128	72.5	465	15.8	428	14.6	37	1.3	0	0.0	344	11.7
Alberta	5,143	4,627	90.0	234	4.5	195	3.8	39	0.8	0	0.0	282	5.5
British Columbia	7,463	6,427	86.1	601	8.1	600	8.0	1	0.0	0	0.0	435	5.8
Yukon	117	49	41.9	42	35.9	42	35.9	0	0.0	0	0.0	26	22.2
Northwest Territories	92	18	19.6	54	58.7	41	44.6	4	4.3	9	9.8	20	21.7
Nunavut	55	1	1.8	54	98.2	0	0.0	0	0.0	54	98.2	0	0.0

[†] 33% or more of total population reported Aboriginal identity on 2001 Census
Source: 2001 Census of Canada.

Table B
Weighted distribution of population in high[†]- and low-Aboriginal dissemination areas, by predominant Aboriginal identity and jurisdiction, Canada, 2001

	Total population	Low-Aboriginal		High-Aboriginal (all)[‡]		First Nations[‡]		Métis[‡]		Inuit[‡]		% Aboriginal unclassifiable	
	Number	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Canada	30,007,270	29,456,805	98.2	519,105	1.7	419,100	1.4	56,315	0.2	43,690	0.1	31,360	0.1
Canada excluding Quebec	**22,769,475**	**22,270,525**	**97.8**	**471,130**	**2.1**	**380,270**	**1.7**	**56,235**	**0.2**	**34,625**	**0.2**	**27,820**	**0.1**
Newfoundland and Labrador	512,945	496,735	96.8	14,575	2.8	3,030	0.6	8,845	1.7	2,700	0.5	1,635	0.3
Prince Edward Island	135,325	134,950	99.7	320	0.2	320	0.2	0	0.0	0	0.0	55	0.0
Nova Scotia	907,995	900,470	99.2	7,090	0.8	7,090	0.8	0	0.0	0	0.0	435	0.0
New Brunswick	729,470	721,910	99.0	6,550	0.9	6,550	0.9	0	0.0	0	0.0	1,010	0.1
Quebec	7,237,795	7,186,280	99.3	47,975	0.7	38,830	0.5	80	0.0	9,065	0.1	3,540	0.0
Ontario	11,410,000	11,350,625	99.5	48,675	0.4	47,800	0.4	875	0.0	0	0.0	10,700	0.1
Manitoba	1,119,470	1,010,650	90.3	107,445	9.6	96,465	8.6	10,980	1.0	0	0.0	1,375	0.1
Saskatchewan	978,730	869,640	88.9	104,770	10.7	88,415	9.0	16,355	1.7	0	0.0	4,320	0.4
Alberta	2,974,715	2,905,685	97.7	65,865	2.2	49,855	1.7	16,010	0.5	0	0.0	3,165	0.1
British Columbia	3,908,040	3,841,220	98.3	62,095	1.6	61,660	1.6	435	0.0	0	0.0	4,725	0.1
Yukon	28,655	22,935	80.0	5,345	18.7	5,345	18.7	0	0.0	0	0.0	375	1.3
Northwest Territories	37,375	15,625	41.8	21,725	58.1	13,740	36.8	2,735	7.3	5,250	14.0	25	0.1
Nunavut	26,755	80	0.3	26,675	99.7	0	0.0	0	0.0	26,675	99.7	0	0.0

[†] 33% or more of total population reported Aboriginal identity on 2001 Census
[‡] numbers and percentages do not represent counts of Aboriginal people; these values represent number and percentage of population in dissemination areas where 33% to 100% of population was Aboriginal
Source: 2001 Census of Canada.

Table C
Distribution of hospitalizations, by high† - and low-Aboriginal dissemination area, and in high-Aboriginal dissemination areas by predominant Aboriginal identity, Canada excluding Quebec, 2001/2002

	Total hospitalizations							Hospitalizations of residents of high-Aboriginal dissemination areas					
	Total	Low-Aboriginal		High-Aboriginal (all)		% Aboriginal unclassifiable		First Nations		Métis		Inuit	
	Number	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Canada excluding Quebec	**2,143,779**	**2,059,462**	**96**	**79,567**	**4**	**4,750**	**0.22**	**67,160**	**84**	**8,157**	**10**	**4,250**	**5**
Newfoundland and Labrador	53,629	51,400	96	2,042	4	187	0.35	498	24	1,140	56	404	20
Prince Edward Island	16,043	15,979	100	58	0	6	0.04	57	98	x	x	x	x
Nova Scotia	91,767	90,745	99	955	1	67	0.07	938	98	x	x	x	x
New Brunswick	99,441	97,915	98	1,369	1	157	0.16	1,361	99	x	x	x	x
Ontario	994,824	983,504	99	9,280	1	2,040	0.21	8,899	96	88	1	293	3
Manitoba	117,254	98,367	84	18,632	16	255	0.22	16,634	89	1,543	8	455	2
Saskatchewan	126,613	108,748	86	17,221	14	644	0.51	15,262	89	1,950	11	x	x
Alberta	286,712	271,436	95	14,519	5	757	0.26	11,368	78	2,947	20	204	1
British Columbia	348,442	338,119	97	9,725	3	598	0.17	9,645	99	76	1	x	x
Yukon	2,423	1,807	75	592	24	24	0.99	590	100	0	0	x	x
Northwest Territories	5,209	1,429	27	3,765	72	15	0.29	1,908	51	401	11	1,456	39
Nunavut	1,422	13	1	1,409	99	0	0	0	0	0	0	1,409	100

† 33% or more of total population reported Aboriginal identity on 2001 Census

x suppressed to meet confidentiality requirements of *Statistics Act*

Notes: For patients hospitalized outside province/territory of residence, hospitalizations were included in totals for jurisdiction reporting discharge. Of total 2,143,779 hospitalizations (excluding Quebec, missing 1.5% of total), 31,447 could not be classified as admissions from either high- or low-Aboriginal dissemination area because of missing or invalid postal code on discharge record.

Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

Table D
Percentage of estimated weighted population living in high† - and low-Aboriginal dissemination areas, by prevalence of missing information for selected area characteristics, Canada excluding Quebec, 2001

Selected area characteristics	High-Aboriginal (all)	First Nations	Métis	Inuit	Aboriginal
Rural	0.0	0.0	0.0	0.0	0.0
Lowest area average household income quintile	8.6	10.0	3.5	2.5	0.3
Labour force participation rate below jurisdiction rate	2.1	7.6	1.4	0.3	0.5
Above-average (jurisdiction) percentage of population aged 20 or older without secondary graduation	2.1	7.6	1.4	0.3	0.5
10% or more private dwellings overcrowded	6.3	7.6	1.4	0.3	0.0
20% or more private dwellings need major repair	2.1	5.2	0.0	0.3	0.5

† 33% or more of total population reported Aboriginal identity on 2001 Census

Source: 2001 Census of Canada.

Table E
Population estimates of incompletely enumerated Indian Reserves and Indian Settlements in 2001 Census

	Number	Estimated population
Canada[†]	**30**	**34,541**
Newfoundland and Labrador	0	0
Prince Edward Island	0	0
Nova Scotia	0	0
New Brunswick	0	0
Quebec	5	12,648
Ontario	17	15,960
Manitoba	1	110
Saskatchewan	1	581
Alberta	3	4,977
British Columbia	3	263
Yukon	0	0
Northwest Territories	0	0
Nunavut[‡]	0	0

[†] rounding may account for small differences in calculation of totals
[‡] Nunavut has no Indian reserves or Indian settlements
Source: 2001 Census of Canada.

Table F
Diagnostic code definitions for selected conditions,[†] by classification system

Most responsible diagnosis	ICD-10	ICD-9
Injury/Poisoning and certain other consequences of external causes	S00-T98	800-999
Mental/Behavioural disorders	F00-F99	290-319
Diseases of circulatory system	I00-I99	2891-2893, 390-459 (except 435), 466, 4590
Diseases of respiratory system	J00-J99	0340, 460-519
Intentional self-harm/Poisoning	X60 - X69	E950 - E952
Intentional self-harm (other)	X70 - X84, Y87.0	E953 - E958, E959
Intentional injury inflicted by others	X85 - X99, Y00 - Y09, Y87.1	E960 - E968, E969
Substance abuse-related mental health disorders	F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F55	291,292,303,304,305
Mood disorders	F30, F31, F32, F33, F34, F38, F39	311, 2960, 2961, 2964, 2965, 2966, 2968, 2962, 2963, 3004, 2969
Pneumonia/Influenza	J12, J13, J14, J15, J16, J17, J18 (except J18.2), J10, J11	480-483, 485-486; 487
Acute bronchitis/Bronchiolitis	J20, J21	466
Asthma	J45	493
Heart failure/Pulmonary edema	I50, J81, J18.2	428, 514, 518.4
Ischemic heart disease		410-414
Acute myocardial infarction	I21, I22	410
Lung cancer	C33, C34	162
Colorectal cancer	C18-C21	153, 154
Cholelithiasis	K80	574
Human immunodeficiency virus disease	B24	042-044
Pregnancy, childbirth and the puerperium	O00 - O99	630 - 676
Selections included for "persons encountering health services in circumstances related to reproduction"	Z32, Z33, Z34, Z35, Z36, Z37, Z39	V22, V23, V24, V28

[†] only most responsible diagnosis was used
Notes: Reported diagnoses may have occurred post-admission. In 2001/2002, Canadian hospitals used one of three disease classification systems: the International Classification of Diseases, 9th revision (ICD-9); the International Classification of Diseases, 9th revision - Clinical Modification (ICD-9CM); or the International Classification of Diseases, 10th revision, Canadian Adaptation (ICD-10-CA). Standardization of disease coding with ICD-9 conversion tables and conceptual cross-walks were performed; some conceptual discrepancies in coding remain for acute myocardial infarction and may have produced slight undercounts in jurisdictions using ICD-10. In ICD-9, acute myocardial infarction was classified as such for 8 weeks from onset; in ICD-10-CA, acute myocardial infarction is classified as such if onset was within 4 weeks. Rates for cancer conditions represent incomplete counts of total cancer cases because admissions with most responsible diagnosis of chemotherapy report cancer secondarily.

Table G
Age-/Sex- standardized[†] hospitalization rates per 10,000 population and rate ratios for International Shortlist for Hospital Morbidity Tabulation heading category,[‡] by high[§]- and low-Aboriginal dissemination area and predominant Aboriginal identity, Canada excluding Quebec, 2001/2002

	Low-Aboriginal		High-Aboriginal (all)		First Nations		Métis		Inuit	
	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio	Rate	Rate ratio
Diseases of respiratory system	61	...	187	3.1	191	3.1	156	2.6	220	3.6
Diseases of circulatory system	137	...	241	1.8	251	1.8	203	1.5	147	1.1
Mental/Behavioural disorders	51	...	106	2.1	113	2.2	78	1.5	80	1.6
Injury, poisoning and certain other consequences of external causes	78	...	204	2.6	216	2.8	156	2.0	146	1.9

[†] standardized to age and sex distributions of population in low-Aboriginal dissemination areas for Canada excluding Quebec in 2001
[‡] hospitalizations having most responsible diagnosis code included in OECD International Shortlist for Hospital Morbidity Tabulation heading category; code ranges according to classification system listed in Appendix A, Table F
[§] 33% or more total population reported Aboriginal identity on 2001 Census
... not applicable
Note: Rate ratios are in relation to "Low-Aboriginal."
Sources: 2001/2002 Hospital Morbidity Database; 2001 Census of Canada.

Appendix B

2001 Census

Census information is collected either with a short questionnaire (2A) or with a long questionnaire (2B), which is administered to a random sample of one in five (20%) households. The long 2B form collects additional information including Aboriginal ancestry, Aboriginal identity, Band/First Nation membership and Registered Indian status. The 2B data are weighted to provide estimates for the entire population.

A different form (2D) is used for the Northern and Reserves Questionnaire. It is a long questionnaire similar to 2B and is used to enumerate the Yukon, the Northwest Territories (except Whitehorse and Yellowknife), Nunavut, Indian reserves, Indian settlements, Indian government districts and *terres réservées*. More information about the 2001 Census is available at: http://www12.statcan.gc.ca/english/census01/home/Index.cfm.

Dissemination area (DA) characteristics in this report were derived from the 2001 Community Profiles and are available at: http://www.statcan.gc.ca/bsolc/olc-cel/olc-cel?catno=95F0495XCB2001002&lang=eng. Public use 2001 Community Profiles data can also be accessed through the Data Liberation Initiative (DLI) (http://www.statcan.gc.ca/stcsr/query.html?qt=Data+Liberation+Initiative&searchbut01=Search&col=alle&ht=0&qp=%2Btopic%3A113113165&qs=&pw=100%25&la=en&qm=1&st=1&oq=&rq=0&si=0&rf=0&style=emp).

Hospital Morbidity Database

The Hospital Morbidity Database (HMDB) is part of the larger hospital Discharge Abstract Database (DAD). The DAD contains a census of acute-care hospital separations (discharges and in-hospital deaths) for the April to March fiscal year. It is submitted to the Canadian Institute for Health Information (CIHI), in addition to other information provided by hospitals in provinces that do not submit to the DAD (Quebec, parts of Manitoba and Alberta, depending on the fiscal year). Additional information about the annual HMDB and detailed information about data quality are available at: www.cihi.ca.

For the HMDB, 2001/2002 was a transition year, as Canadian hospitals were completing implementation of the 10th revision of the International Disease Classification coding system. Depending on the province or territory, discharge information was reported according to one or more of three classification systems: International Classification of Diseases, 10th revision, Canadian Adaptation (ICD10-CA); International Classification of Diseases, 9th revision (ICD 9); or International Classification of Diseases, 9th revision - Clinical Modification (ICD 9-CM). For some analysis, coding conversion tables with information about the conversion grade quality produced by CIHI were used to convert codes to the ICD-9 system. For broad disease category classification (Figure 6), validated internationally accepted disease constructs that are comparable across classification systems and listed in the "International Shortlist for Hospital Morbidity Tabulation" (ISHMT) [46] were used. Background information about the rationale, history and process of development for the ISHMT is available at: http://www.who.int/classifications/icd/implementation/morbidity/ishmt/en/index.html.

Appendix C

Supplementary methods information

Dissemination areas (DAs), the smallest geographic areas for which all census data are available, were used for this analysis. DA populations range from 400 to 700 persons and can represent a single city block in heavily populated urban areas or a much larger area in remote regions. In the 2001 Census, there were 52,993 dissemination areas.

In 2001, population information was missing for 2,689 DAs, which could not be classified as either a high- or low-percentage Aboriginal (0.05% of all 2001 DAs). Excluding Quebec, the number of unclassifiable DAs totaled 2,406, with an estimated population of 27,820 (0.1% of the total population of Canada excluding Quebec).

For census population counts, no adjustment was made for undercounting below the Census Division (CD) level. For information about under-enumerated areas for the 2001 Census and estimated populations in Indian Reserves, see Appendix A, Table E, and http://www12.statcan.ca/english/census01/Meta/indres.cfm.

Based on census information, a percentage Aboriginal was calculated for each DA.[12] The percentage Aboriginal is the number of people in the DA claiming Aboriginal identity, divided by the DA's total population.

The PCCF+[19] was used to assign a DA code to each postal code in the hospital discharge database. In some parts of Canada, postal codes do not correspond precisely to a single DA. In these cases, the PCCF+ completes an unbiased assignment to one DA after taking weighted population counts for each possible DA into consideration. Assignment of a percentage Aboriginal to each DA accounts for the fact that DA code assignment for postal codes has been determined probabilistically from (mostly rural) postal codes that span multiple DAs. The percentage Aboriginal is a weighted average of the percentage Aboriginal in all of the DAs that could have been selected.

Quebec was excluded from these analyses because the data submitted by that province include only Forward Sortation Area (FSA) codes rather than 6-digit postal codes.

More information about the PCCF+ and the reference files used in assigning of DA codes to the neighbourhood income quintile value for each DA using postal codes is available at: \\geodepot2\FTP\Geographie_2006_Geography\Geo_Data_Products-Produits_de_données_Géo\PCCFplus_version5E_Mar09, or from Russell Wilkins (613-951-5305; russell.wilkins@statcan.gc.ca), Health Analysis Division, Statistics Canada.