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by Evelyne Bougie

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ABSTRACT

Background

The objective of this study was to describe sex-specific hospitalization rates among Indigenous people in Canada (excluding Quebec), separately for First Nations people living on and off reserve, Inuit living in Inuit Nunangat (excluding Nunavik), Métis, and the non-Indigenous population.

Data and methods

The 2006 and 2011 Canadian Census Health and Environment Cohorts (CanCHECs) were used, allowing hospital records to be examined by Indigenous identity as reported on the census. Five years of hospitalization data were used for each CanCHEC. Causes of hospitalization were based on the most responsible diagnosis and coded at the chapter level according to the International Classification of Diseases (ICD-10-CA). Age-standardized hospitalization rates (ASHRs) were calculated per 100,000 population, and rate ratios (RRs) were calculated for each Indigenous group relative to non-Indigenous people.

Results

ASHRs were higher among Indigenous people than among non-Indigenous people; this was true for females and males from both the 2006 and the 2011 cohorts. Hospitalization patterns varied by sex and Indigenous group. The greatest disparities with the non-Indigenous population were observed among on-reserve First Nations females and males from both cohorts. Elevated RRs were observed for diseases of the endocrine, nutritional and metabolic system among First Nations females and males living on reserve; hospitalizations for mental health among First Nations females and males living off reserve and Inuit males; and diseases of the respiratory system among Inuit females. For Métis females and males, equally elevated RRs were observed for diseases of the endocrine system and mental health. ASHRs for most causes decreased between the 2006 and 2011 cohorts, with the exception of ASHRs for mental health among First Nations females and males living on reserve, which increased.

Interpretation

Findings are consistent with recognized health disparities between Indigenous and non-Indigenous people. Further research is warranted to understand reported differences in hospitalization patterns.

Keywords

Administrative data, CanCHEC, census, data linkage, First Nations, health care, hospital records, Inuit, Inuit Nunangat, Métis, on-reserve

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What is already known on this subject?

- A number of studies have shown higher acute-care hospitalization rates in Canada among First Nations people, Métis and Inuit, compared with the non-Indigenous population.
- No national studies to date have examined sex-specific hospitalization rates among Indigenous people, nor have any investigated patterns over time.

What does this study add?

- In its call to action 19, the Truth and Reconciliation Commission of Canada has called upon the federal government to publish data and assess long-term trends for a number of health indicators for Indigenous people.
- Acute-care hospitalization data are important for informing health policy and service delivery planning.
- This study makes the following contributions to investigating hospitalization patterns among the Indigenous household population in Canada (excluding Quebec). First, a standardized approach is used to compare rates for members of two CanCHECs (2006 and 2011). Second, sex-specific hospitalization rates are estimated. And third, a distinctions-based analytic lens is used to explore hospitalizations among First Nations people living on and off reserve, Inuit living in Inuit Nunangat (excluding Nunavik), and Métis.

In Canada, there are continuing disparities in health outcomes between the Indigenous and non-Indigenous populations.¹⁻¹¹ The reasons behind these disparities are complex. It is recognized that the ongoing effects of colonization, racism and intergenerational trauma on Indigenous people, as well as their greater disadvantage in many of the social determinants of health relative to the non-Indigenous population, have contributed to their poorer health outcomes.¹²⁻¹⁶

It is necessary to identify and close these health disparities¹ by monitoring change over time. This study focuses on acute-care hospitalizations among First Nations people, Inuit and Métis in Canada. Hospital-based acute inpatient care is an important element of health services in Canada, as it provides necessary treatment for a disease, severe episode of illness or any other health condition for a short period of time. Even though acute-care hospitalization data are affected by many factors other than health status—including the availability of care, physical and financial accessibility, administrative decisions, and hospital specialization²—they provide important insight into the health of a population. They also indicate which diseases, disorders and health conditions place the greatest demand on the health care system.

Producing acute-care hospitalization rates among the Indigenous population in Canada is methodologically challenging since hospital administrative databases typically do not contain information on whether a patient identified as an Indigenous person. In 2016, national hospitalization rates (both sexes combined, Quebec excluded) were published for the first time for First Nations people living on and off reserve, Métis, and Inuit living in Inuit Nunangat, using the 2006 Census long-form questionnaire linked to three years of the Discharge Abstract Database (DAD).¹⁷ Linking hospital and census

records allows hospitalization rates to be examined by Indigenous identity, as reported on the census. Since that time, the methods used at Statistics Canada to create linked data have improved through the development of a series of datasets branded as the Canadian Census Health and Environment Cohorts (CanCHECs). The CanCHECs are a series of population-based, probabilistically linked datasets that combine data from respondents to the long-form census questionnaire or the 2011 National Household Survey (NHS) with administrative health data. The CanCHECs were created using a consistent record linkage methodology applied to current and past cohorts based on the long-form census questionnaire and the NHS to make them comparable over time.

The purpose of this study was to use a standardized approach in two CanCHECs (2006 and 2011) to estimate sex-specific hospitalization rates in Canada (excluding Quebec) among First Nations people living on and off reserve, Inuit living in Inuit Nunangat (excluding Nunavik), and Métis. The following research questions were addressed: (1) How do leading causes of hospitalization and rates from the 2006 cohort compare with those from the 2011 cohort? (2) How do leading causes of hospitalization and rates differ for females and males and by Indigenous group? (3) What are the largest disparities in hospitalization rates between Indigenous and non-Indigenous females and males?

Methods

Data sources

This study used the 2006 and 2011 CanCHECs.¹⁸ The CanCHEC datasets were created using the Social Data Linkage Environment (SDLE), which facilitates the creation of linked

population data files using the Derived Record Depository (DRD). The DRD is a database that contains only basic personal identifiers. The 2006 and 2011 CanCHECs were created within the SDLE from a probabilistic linkage between eligible census and NHS records and the DRD. After the CanCHECs were linked to the DRD, DAD data (previously linked to the DRD) were linked to the CanCHEC datasets. The linkage rates for applicable years of the DAD to the DRD ranged from 92.7% to 95.8%.¹⁸

For this study, data from the 2006 Census long-form questionnaire were linked to DAD records with admission dates spanning from May 15, 2006, to May 14, 2011. Data from the 2011 NHS were linked to DAD records with admission dates spanning from May 10, 2011, to May 9, 2016. Pooling hospital records over five years of follow-up reduces the variation that can occur with small numbers of events. A linkage of data from the 2016 Census to five years of DAD records (2016/2017 to 2020/2021) was not available at the time of this analysis.

Only the non-institutional population and people who were enumerated in the census or the NHS were eligible for CanCHEC inclusion. Because the NHS excluded residents of collective dwellings, the 2006 CanCHEC also then excluded collective dwellings to make it comparable to the 2011 CanCHEC. Collective dwellings include rooming or lodging houses, hotels, motels, tourist homes, nursing homes, hospitals, staff residences, communal quarters of military camps, work camps, jails, missions and group homes.

The DAD compiles approximately 3 million hospital records annually from all acute-care facilities and some psychiatric, chronic rehabilitation and day surgery facilities in all provinces and territories, excluding Quebec.¹⁹ DAD data are provided annually to Statistics Canada by the Canadian Institute for Health Information. Quebec does not submit data to the DAD. As a result of this exclusion, people living in Quebec (including Inuit living in Nunavik) are not reflected in this study, and neither are hospitalizations of out-of-province residents in Quebec. Also, since 2005, Ontario has been reporting mental health hospitalizations to the Ontario Mental Health Reporting System rather than to the DAD. Therefore, acute-care mental health hospitalizations in Ontario are underreported in the DAD.

Indigenous identity

Respondents were classified according to the Indigenous identity they self-reported in the 2006 Census long-form questionnaire and the 2011 NHS (note that these data sources used the term “Aboriginal”). First Nations, Inuit and Métis populations were defined by single responses to the Indigenous identity question. People who reported multiple Indigenous identities—a small proportion of the total Indigenous identity population (e.g., less than 1% in the 2011 NHS)—were not classified separately and were excluded. The non-Indigenous population was identified as people who did not report being First Nations, Métis or Inuit through the Indigenous identity

question; did not report being a Registered or Status Indian; and did not report being a member of a First Nation or Indian band.

Place of residence

Respondents' place of residence as reported on Census Day or NHS Day was used to identify Inuit living in Inuit Nunangat and First Nations people living on reserve. Using the place of residence on Census Day or NHS Day, as opposed to the provincial or territorial location of the hospital that submitted a given discharge record, enabled linked hospitalizations that occurred in a province or territory different from the province or territory of residence at the time of the census or NHS to be reported. Note that respondents' place of residence may have changed during the study period, and this was not taken into account in this study.

Inuit Nunangat is the homeland of Inuit of Canada and includes the communities located in the four Inuit regions: Nunatsiavut (northern coastal Labrador), Nunavik (northern Quebec), the territory of Nunavut, and the Inuvialuit region of the Northwest Territories. The majority (about three-quarters) of Inuit in Canada reside in Inuit Nunangat. Note that since Quebec does not submit data to the DAD, Inuit living in Nunavik were not represented in this study.

The on-reserve population was derived using census and NHS standards according to criteria established by the Department of Indigenous Services Canada.^{20,21} “On reserve” includes different types of census subdivisions (CSDs) legally affiliated with First Nations or Indian bands. In 2006, 22 Indian reserves and settlements were incompletely enumerated in the census; there were 18 in the 2011 NHS.²² To enable comparisons between the two CanCHECs, in this study, only CSDs that were considered to be “on reserve” in both 2006 and 2011 were classified as on reserve. There were 883 on-reserve CSDs in 2006 and 802 in 2011; this study includes 716 on-reserve CSDs that were considered as such in both years. Approximately 11% of the on-reserve study population in 2006, and 6% in 2011, was excluded as a result of this restriction.

Causes of hospitalization

Each hospital discharge record contains up to 25 diagnostic and 20 intervention codes. Causes of acute-care hospitalizations in the DAD were based on the most responsible diagnosis (MRDx), that is, the first diagnostic code that indicates the most significant diagnosed condition or the condition accounting for the longest length of stay. Causes were coded according to the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (Canada; ICD-10-CA).²³ The first three characters of each MRDx were used to classify hospitalizations by chapter. The codes and full chapter names are shown in Appendix A, and shorter forms will be used in the text. Individuals could be represented more than once if they were hospitalized multiple times during the follow-up period. Rates for a given chapter, therefore, represent hospitalizations, not people. Note that any hospitalization with a Chapter 15

(pregnancy, childbirth and the puerperium) MRDx indicates that there were some complications.

Analytical techniques

Descriptive statistics were produced. Age-standardized hospitalization rates (ASHRs) per 100,000 population and 95% confidence intervals (CIs) were calculated for each Indigenous

Table 1
Age-standardized^a hospitalization rates per 100,000 person-years and rate ratios^b for the female household population, by cause and population group, Canada, excluding Quebec,^c 2006 and 2011 Canadian Census Health and Environment Cohorts

Causes of hospitalization ^d	2006						2011						Rate difference
	ASHR	95% CI		RR	95% CI		ASHR	95% CI		RR	95% CI		
		from	to		from	to		from	to		from	to	
First Nations females living on reserve^e (excluding Quebec)													
All causes combined (births included)	19,854.3	19,590.7	20,118.0	2.9	2.86	2.94	17,522.7	17,172.6	17,872.8	2.7	2.63	2.74	-2,331.6 [§]
All causes combined (births excluded)	15,388.2	15,136.5	15,639.9	3.2	3.11	3.21	13,523.5	13,213.4	13,833.5	2.9	2.85	2.99	-1,864.7 [§]
Pregnancy, childbirth and the puerperium	5,477.8	5,391.6	5,563.9	2.6	2.58	2.67	4,754.2	4,649.5	4,858.8	2.4	2.30	2.41	-723.6 [§]
Diseases of the digestive system	2,017.6	1,952.2	2,083.1	3.3	3.15	3.37	1,704.9	1,636.0	1,773.7	3.0	2.89	3.15	-312.7 [§]
Diseases of the respiratory system	1,792.5	1,722.5	1,862.6	4.5	4.28	4.66	1,385.8	1,317.5	1,454.0	3.7	3.47	3.86	-406.7 [§]
Injuries	1,556.7	1,510.8	1,602.7	3.4	3.33	3.55	1,449.5	1,396.5	1,502.5	3.3	3.18	3.44	-107.2 [§]
Diseases of the circulatory system	1,135.4	1,083.3	1,187.5	2.3	2.17	2.39	931.6	882.7	980.4	2.2	2.03	2.27	-203.8 [§]
Mental and behavioural disorders	777.9	727.2	828.5	3.5	3.23	3.72	919.2	865.1	973.3	3.4	3.15	3.59	141.3 [§]
Endocrine, nutritional and metabolic diseases	765.8	719.2	812.5	5.2	4.84	5.54	660.6	619.1	702.1	4.0	3.75	4.33	-105.2 [§]
Diseases of the genitourinary system	1,037.2	1,000.3	1,074.2	2.4	2.33	2.51	969.7	927.7	1,011.6	2.6	2.45	2.69	-67.5
Diseases of the musculoskeletal system and connective tissue	557.5	526.1	589.0	1.7	1.56	1.75	465.9	438.1	493.6	1.4	1.31	1.48	-91.6 [§]
First Nations females living off reserve (excluding Quebec)													
All causes combined (births included)	12,611.2	12,265.4	12,957.0	1.8	1.79	1.90	11,126.0	10,727.8	11,524.2	1.7	1.64	1.76	-1,485.2 [§]
All causes combined (births excluded)	9,572.2	9,243.0	9,901.4	2.0	1.90	2.03	8,508.6	8,133.1	8,884.0	1.8	1.76	1.92	-1,063.6 [§]
Pregnancy, childbirth and the puerperium	3,435.7	3,309.9	3,561.6	1.6	1.58	1.71	2,903.3	2,778.3	3,028.3	1.4	1.38	1.50	-532.4 [§]
Diseases of the digestive system	1,317.9	1,225.2	1,410.6	2.1	1.98	2.29	1,069.2	954.9	1,183.6	1.9	1.70	2.11	-248.7 [§]
Diseases of the respiratory system	987.9	889.2	1,086.5	2.5	2.23	2.72	795.4	694.8	896.0	2.1	1.85	2.39	-192.5
Injuries	967.5	906.3	1,028.8	2.1	2.00	2.28	869.0	797.9	940.1	2.0	1.82	2.15	-98.5
Diseases of the circulatory system	723.5	631.0	816.0	1.5	1.28	1.65	629.8	553.0	706.6	1.5	1.28	1.64	-93.7
Mental and behavioural disorders	727.3	653.5	801.1	3.2	2.92	3.60	812.2	728.4	896.0	3.0	2.67	3.31	84.9
Endocrine, nutritional and metabolic diseases	394.7	333.7	455.7	2.7	2.28	3.12	372.0	307.0	436.9	2.3	1.90	2.71	-22.7
Diseases of the genitourinary system	760.4	707.0	813.8	1.8	1.65	1.90	684.3	620.1	748.5	1.8	1.65	1.99	-76.1
Diseases of the musculoskeletal system and connective tissue	442.7	401.7	483.7	1.3	1.20	1.44	389.9	350.4	429.5	1.2	1.05	1.29	-52.8
Inuit females living in Inuit Nunangat (excluding Nunavik)													
All causes combined (births included)	13,643.2	13,099.4	14,187.1	2.0	1.92	2.08	13,496.7	12,891.7	14,101.6	2.1	1.97	2.16	-146.5
All causes combined (births excluded)	10,511.1	9,999.4	11,022.8	2.2	2.06	2.27	10,299.1	9,754.2	10,844.0	2.2	2.11	2.34	-212.0
Pregnancy, childbirth and the puerperium	3,407.7	3,235.3	3,580.1	1.6	1.55	1.72	3,365.8	3,165.1	3,566.5	1.7	1.57	1.77	-41.9
Diseases of the digestive system	1,216.0	1,090.1	1,342.0	2.0	1.77	2.18	1,208.3	1,068.7	1,348.0	2.1	1.91	2.40	-7.7
Diseases of the respiratory system	1,490.7	1,299.3	1,682.1	3.7	3.27	4.23	1,375.2	1,156.9	1,593.5	3.6	3.10	4.26	-115.5
Injuries	1,133.9	1,029.1	1,238.6	2.5	2.28	2.75	992.9	889.3	1,096.5	2.3	2.04	2.51	-141.0
Diseases of the circulatory system	623.2	507.8	738.5	1.3	1.04	1.50	584.7	481.4	688.1	1.4	1.13	1.61	-38.5
Mental and behavioural disorders	609.9	523.7	696.2	2.7	2.35	3.13	592.4	480.1	704.7	2.2	1.79	2.63	-17.5
Endocrine, nutritional and metabolic diseases	122.0	83.6	160.4	0.8	0.60	1.13	150.9	84.3	217.5	0.9	0.59	1.43	28.9
Diseases of the genitourinary system	613.3	543.8	682.9	1.4	1.28	1.60	491.6	418.4	564.8	1.3	1.12	1.51	-121.7
Diseases of the musculoskeletal system and connective tissue	438.2	366.6	509.9	1.3	1.11	1.53	455.4	376.6	534.2	1.4	1.14	1.62	17.2

... not applicable

[§] The CIs for the rate difference do not overlap.

a. Hospitalization rates were age-standardized using the direct method based on the age structure of the national Indigenous population from the 2011 CanCHEC (both sexes combined, Quebec excluded).

b. The reference group for RRs is the non-Indigenous population (same sex, same cohort). An RR can be said to be significant if its CI does not include zero.

c. DAD data are not available for Quebec.

d. Causes of hospitalization are based on the most responsible diagnosis.

e. To make 2006 CanCHEC rates comparable to 2011 CanCHEC rates, only census subdivisions that were considered to be reserves in both 2006 and 2011 were classified as "on reserve."

Notes: ASHR = Age-standardized hospitalization rates. RR = Rate ratios. CanCHEC = Canadian Census Health and Environment Cohort. CI = Confidence interval. DAD = Discharge Abstract Database. Collective dwellings were excluded from the 2006 CanCHEC to make rates comparable to the 2011 CanCHEC. Collective dwellings refer to dwellings of a commercial, institutional or communal nature. Collective dwellings also include rooming or lodging houses, hotels, motels, tourist homes, nursing homes, hospitals, staff residences, communal quarters of military camps, work camps, jails, missions, group homes, and so on. Collective dwellings may be occupied by usual residents or solely by foreign or temporary residents. A sampling weight was applied to make the cohort more representative of the target population and to reduce bias because of missed links. Generalized bootstrap weights were derived from the final cohort weight. Bootstrap replicate weights were used to estimate appropriate standard errors and 95% CIs.

Sources: 2006 and 2011 Canadian Census Health and Environment Cohorts (2006 Census data linked to 2006/2007-to-2010/2011 DAD records, and 2011 National Household Survey data linked to 2011/2012-to-2015/2016 DAD records).

Table 1
Age-standardized^a hospitalization rates per 100,000 person-years and rate ratios^b for the female household population, by cause and population group, Canada, excluding Quebec,^c 2006 and 2011 Canadian Census Health and Environment Cohorts (continued)

Causes of hospitalization ^d	2006						2011						Rate difference
	ASHR	95% CI		RR	95% CI		ASHR	95% CI		RR	95% CI		
		from	to		from	to		from	to		from	to	
Métis females (excluding Quebec)													
All causes combined (births included)	9,952.9	9,703.8	10,202.1	1.5	1.42	1.49	8,971.1	8,660.9	9,281.3	1.4	1.33	1.42	-981.8 [§]
All causes combined (births excluded)	7,454.6	7,223.1	7,686.1	1.5	1.48	1.58	6,766.0	6,483.2	7,048.9	1.5	1.40	1.52	-688.6 [§]
Pregnancy, childbirth and the puerperium	2,804.9	2,701.2	2,908.7	1.3	1.29	1.39	2,447.1	2,324.1	2,570.1	1.2	1.15	1.28	-357.8 [§]
Diseases of the digestive system	1,023.1	954.8	1,091.4	1.7	1.55	1.77	860.6	796.6	924.5	1.5	1.41	1.64	-162.5 [§]
Diseases of the respiratory system	746.1	671.9	820.2	1.9	1.68	2.06	594.8	518.9	670.6	1.6	1.38	1.79	-151.3 [§]
Injuries	696.4	647.5	745.3	1.5	1.43	1.65	617.2	560.2	674.1	1.4	1.28	1.54	-79.2
Diseases of the circulatory system	647.5	581.7	713.2	1.3	1.17	1.44	528.6	463.0	594.2	1.2	1.07	1.38	-118.9
Mental and behavioural disorders	496.2	440.1	552.2	2.2	1.97	2.48	519.7	453.9	585.5	1.9	1.67	2.17	23.5
Endocrine, nutritional and metabolic diseases	256.5	222.4	290.5	1.7	1.52	1.99	314.1	243.1	385.1	1.9	1.53	2.41	57.6
Diseases of the genitourinary system	647.9	602.4	693.5	1.5	1.41	1.62	591.2	533.0	649.4	1.6	1.42	1.73	-56.7
Diseases of the musculoskeletal system and connective tissue	381.8	343.1	420.6	1.1	1.02	1.26	372.8	333.2	412.5	1.1	1.00	1.24	-9.0
Non-Indigenous females (excluding Quebec)													
All causes combined (births included)	6,837.1	6,811.6	6,862.7	...	...	...	6,538.5	6,504.7	6,572.3	...	...	...	-298.6 [§]
All causes combined (births excluded)	4,870.9	4,848.0	4,893.7	...	...	...	4,632.6	4,602.8	4,662.5	...	...	...	-238.3 [§]
Pregnancy, childbirth and the puerperium	2,089.4	2,077.4	2,101.4	...	...	...	2,016.8	1,998.9	2,034.7	...	...	...	-72.6 [§]
Diseases of the digestive system	619.0	612.6	625.3	...	...	...	564.6	556.3	572.9	...	...	...	-54.4 [§]
Diseases of the respiratory system	401.3	395.4	407.2	...	...	...	378.4	370.8	386.1	...	...	...	-22.9 [§]
Injuries	453.0	448.0	458.1	...	...	...	438.6	432.4	444.8	...	...	...	-14.4 [§]
Diseases of the circulatory system	498.3	493.4	503.1	...	...	...	434.1	427.8	440.5	...	...	...	-64.2 [§]
Mental and behavioural disorders	224.6	218.5	230.7	...	...	...	273.2	264.8	281.5	...	...	...	48.6 [§]
Endocrine, nutritional and metabolic diseases	147.8	143.5	152.1	...	...	...	163.8	158.0	169.6	...	...	...	16.0 [§]
Diseases of the genitourinary system	428.7	424.1	433.4	...	...	...	377.4	371.9	383.0	...	...	...	-51.3 [§]
Diseases of the musculoskeletal system and connective tissue	336.5	332.7	340.2	...	...	...	335.1	330.8	339.5	...	...	...	-1.4

... not applicable

[§]The CIs for the rate difference do not overlap.

a. Hospitalization rates were age-standardized using the direct method based on the age structure of the national Indigenous population from the 2011 CanCHEC (both sexes combined, Quebec excluded).

b. The reference group for RRs is the non-Indigenous population (same sex, same cohort). An RR can be said to be significant if its CI does not include zero.

c. DAD data are not available for Quebec.

d. Causes of hospitalization are based on the most responsible diagnosis.

g. To make 2006 CanCHEC rates comparable to 2011 CanCHEC rates, only census subdivisions that were considered to be reserves in both 2006 and 2011 were classified as "on reserve."

Notes: ASHR = Age-standardized hospitalization rates. RR = Rate ratios. CanCHEC = Canadian Census Health and Environment Cohort. CI = Confidence interval. DAD = Discharge Abstract Database. Collective dwellings were excluded from the 2006 CanCHEC to make rates comparable to the 2011 CanCHEC. Collective dwellings refer to dwellings of a commercial, institutional or communal nature. Collective dwellings also include rooming or lodging houses, hotels, motels, tourist homes, nursing homes, hospitals, staff residences, communal quarters of military camps, work camps, jails, missions, group homes, and so on. Collective dwellings may be occupied by usual residents or solely by foreign or temporary residents. A sampling weight was applied to make the cohort more representative of the target population and to reduce bias because of missed links. Generalized bootstrap weights were derived from the final cohort weight. Bootstrap replicate weights were used to estimate appropriate standard errors and 95% CIs.

Sources: 2006 and 2011 Canadian Census Health and Environment Cohorts (2006 Census data linked to 2006/2007-to-2010/2011 DAD records, and 2011 National Household Survey data linked to 2011/2012-to-2015/2016 DAD records).

group and the non-Indigenous population, separately for females and males. The direct method was used for age standardization, based on the age structure of the national Indigenous population from the 2011 CanCHEC (both sexes combined, Quebec excluded). The age groups were 0 to 9, 10 to 19, 20 to 29, 30 to 39, 40 to 49, and 50 and older. The follow-up period was censored at time of death for individuals known to have died.

ASHRs from the 2006 and 2011 cohorts were compared via a rate difference calculation and were considered significantly different if their CIs did not overlap. Rate ratios (RRs) and their 95% CIs were calculated to compare ASHRs of the Indigenous population with those of the non-Indigenous population. An RR can be said to be significant if its CI does not include zero.

Sampling weights were applied to make the cohorts representative of the target population and to reduce bias because of missed links. Bootstrap replicate weights were used to estimate appropriate standard errors and 95% CIs. CanCHEC rules were applied to prevent disclosure and residual disclosure risks of any confidential information provided to Statistics Canada either by survey respondents or through administrative data.

Results

The total 2006 CanCHEC (Appendix B) consisted of 190,465 First Nations people living on reserve (accounting for 144,300 hospitalizations), 71,755 First Nations people living off reserve (37,860 hospitalizations), 25,795 Inuit living in Inuit Nunangat

(excluding Nunavik) (13,035 hospitalizations), 75,535 Métis (35,850 hospitalizations), and 4,040,690 non-Indigenous people (1,511,250 hospitalizations).

(34,370 hospitalizations), and 4,492,415 non-Indigenous people (1,613,000 hospitalizations).

The total 2011 CanCHEC (Appendix C) consisted of 193,795 First Nations people living on reserve (accounting for 136,215 hospitalizations), 89,785 First Nations people living off reserve (41,780 hospitalizations), 22,620 Inuit living in Inuit Nunangat (excluding Nunavik) (11,520 hospitalizations), 80,275 Métis

ASHRs, RRs and rate differences for both cohorts are presented separately for females (Table 1) and males (Table 2).

Table 2
Age-standardized^a hospitalization rates per 100,000 person-years and rate ratios^b for the male household population, by cause and population group, Canada, excluding Quebec,^c 2006 and 2011 Canadian Census Health and Environment Cohorts

Causes of hospitalization ^d	2006					2011					Rate difference		
	ASHR	95% CI		RR		ASHR	95% CI		RR				
		from	to				from	to					
First Nations males living on reserve^e (excluding Quebec)													
All causes combined	11,811.7	11,578.5	12,044.8	2.5	2.47	2.57	10,840.2	10,560.5	11,119.9	2.4	2.35	2.48	-971.5 [§]
Diseases of the digestive system	1,522.5	1,461.7	1,583.4	2.4	2.26	2.45	1,379.6	1,318.1	1,441.1	2.3	2.18	2.39	-142.9 [§]
Diseases of the respiratory system	1,443.1	1,381.0	1,505.1	3.1	2.95	3.23	1,203.8	1,141.9	1,265.7	2.6	2.50	2.79	-239.3 [§]
Injuries	1,763.0	1,715.4	1,810.6	3.3	3.17	3.36	1,546.1	1,492.0	1,600.2	3.1	2.99	3.23	-216.9 [§]
Diseases of the circulatory system	1,414.8	1,355.3	1,474.3	1.8	1.74	1.89	1,191.0	1,133.5	1,248.6	1.7	1.63	1.80	-223.8 [§]
Mental and behavioural disorders	824.3	773.7	874.9	4.1	3.81	4.35	981.7	913.7	1,049.7	4.1	3.81	4.45	157.4 [§]
Endocrine, nutritional and metabolic diseases	784.4	734.0	834.8	6.1	5.63	6.50	703.8	656.0	751.7	5.2	4.85	5.66	-80.6
Diseases of the genitourinary system	392.9	366.6	419.3	1.7	1.55	1.78	388.2	356.1	420.4	1.7	1.52	1.80	-4.7
Diseases of the musculoskeletal system and connective tissue	409.6	386.6	432.7	1.4	1.28	1.44	436.5	407.2	465.7	1.5	1.38	1.58	26.9
First Nations males living off reserve (excluding Quebec)													
All causes combined	7,539.7	7,234.1	7,845.3	1.6	1.55	1.68	6,896.4	6,480.6	7,312.3	1.5	1.45	1.63	-643.3
Diseases of the digestive system	974.7	889.9	1,059.5	1.5	1.38	1.64	913.5	757.0	1,070.0	1.5	1.27	1.79	-61.2
Diseases of the respiratory system	880.4	787.1	973.6	1.9	1.69	2.10	690.6	595.3	786.0	1.5	1.32	1.74	-189.8 [§]
Injuries	1,038.8	972.8	1,104.8	1.9	1.80	2.05	915.7	833.9	997.5	1.8	1.68	2.02	-123.1
Diseases of the circulatory system	1,072.7	972.5	1,173.0	1.4	1.25	1.51	898.5	796.5	1,000.6	1.3	1.15	1.45	-174.2
Mental and behavioural disorders	561.3	493.5	629.1	2.8	2.45	3.13	661.0	546.6	775.4	2.8	2.33	3.31	99.7
Endocrine, nutritional and metabolic diseases	322.9	268.8	377.0	2.5	2.10	2.95	304.1	234.6	373.6	2.3	1.80	2.85	-18.8
Diseases of the genitourinary system	278.1	241.7	314.5	1.2	1.03	1.34	253.0	208.3	297.8	1.1	0.90	1.29	-25.1
Diseases of the musculoskeletal system and connective tissue	377.6	332.4	422.8	1.3	1.11	1.41	325.5	283.5	367.5	1.1	0.97	1.25	-52.1
Inuit males living in Inuit Nunangat (excluding Nunavik)													
All causes combined	8,036.0	7,554.8	8,517.1	1.7	1.62	1.82	7,294.2	6,823.0	7,765.5	1.6	1.52	1.73	-741.8
Diseases of the digestive system	1,156.0	1,018.0	1,294.0	1.8	1.58	2.01	995.3	872.2	1,118.5	1.6	1.45	1.86	-160.7
Diseases of the respiratory system	1,172.4	974.2	1,370.6	2.5	2.12	2.97	857.9	731.8	984.0	1.9	1.62	2.18	-314.5
Injuries	1,198.1	1,094.5	1,301.7	2.2	2.04	2.42	1,044.7	939.8	1,149.7	2.1	1.90	2.32	-153.4
Diseases of the circulatory system	852.9	727.4	978.3	1.1	0.94	1.27	745.6	638.3	852.8	1.1	0.93	1.24	-107.3
Mental and behavioural disorders	619.4	522.2	716.6	3.1	2.61	3.58	744.3	615.3	873.3	3.1	2.62	3.73	124.9
Endocrine, nutritional and metabolic diseases	94.1	65.3	123.0	0.7	0.53	0.99	65.5	38.8	92.2	0.5	0.32	0.73	-28.6
Diseases of the genitourinary system	224.7	171.2	278.2	1.0	0.75	1.21	187.8	134.1	241.5	0.8	0.60	1.07	-36.9
Diseases of the musculoskeletal system and connective tissue	355.7	292.4	419.1	1.2	0.98	1.41	325.7	260.8	390.6	1.1	0.90	1.34	-30.0

... not applicable

[§]The CIs for the rate difference do not overlap.

a. Hospitalization rates were age-standardized using the direct method based on the age structure of the national Indigenous population from the 2011 CanCHEC (both sexes combined, Quebec excluded).

b. The reference group for RRs is the non-Indigenous population (same sex, same cohort). An RR can be said to be significant if its CI does not include zero.

c. DAD data are not available for Quebec.

d. Causes of hospitalization are based on the most responsible diagnosis.

g. To make 2006 CanCHEC rates comparable to 2011 CanCHEC rates, only census subdivisions that were considered to be reserves in both 2006 and 2011 were classified as "on reserve."

Notes: ASHR = Age-standardized hospitalization rates. RR = Rate ratios. CanCHEC = Canadian Census Health and Environment Cohort. CI = Confidence interval. DAD = Discharge Abstract Database. Collective dwellings were excluded from the 2006 CanCHEC to make rates comparable to the 2011 CanCHEC. Collective dwellings refer to dwellings of a commercial, institutional or communal nature. Collective dwellings also include rooming or lodging houses, hotels, motels, tourist homes, nursing homes, hospitals, staff residences, communal quarters of military camps, work camps, jails, missions, group homes, and so on. Collective dwellings may be occupied by usual residents or solely by foreign or temporary residents. A sampling weight was applied to make the cohort more representative of the target population and to reduce bias because of missed links. Generalized bootstrap weights were derived from the final cohort weight. Bootstrap replicate weights were used to estimate appropriate standard errors and 95% CIs.

Sources: 2006 and 2011 Canadian Census Health and Environment Cohorts (2006 Census data linked to 2006/2007-to-2010/2011 DAD records, and 2011 National Household Survey data linked to 2011/2012-to-2015/2016 DAD records).

Table 2
Age-standardized^a hospitalization rates per 100,000 person-years and rate ratios^b for the male household population, by cause and population group, Canada, excluding Quebec,^c 2006 and 2011 Canadian Census Health and Environment Cohorts (continued)

Causes of hospitalization ^d	2006						2011						Rate difference
	ASHR	95% CI		RR	95% CI		ASHR	95% CI		RR	95% CI		
Métis males (excluding Quebec)													
All causes combined	6,375.4	6,139.7	6,611.2	1.4	1.31	1.41	5,813.3	5,540.2	6,086.4	1.3	1.23	1.36	-562.1 [§]
Diseases of the digestive system	821.6	762.0	881.2	1.3	1.18	1.36	782.9	708.6	857.2	1.3	1.18	1.42	-38.7
Diseases of the respiratory system	688.5	618.4	758.7	1.5	1.33	1.63	632.1	540.7	723.5	1.4	1.20	1.60	-56.4
Injuries	823.1	765.9	880.2	1.5	1.42	1.64	725.6	658.8	792.5	1.5	1.33	1.60	-97.5
Diseases of the circulatory system	954.8	883.0	1,026.7	1.2	1.14	1.32	821.0	735.9	906.2	1.2	1.06	1.31	-133.8
Mental and behavioural disorders	457.5	387.1	527.9	2.3	1.93	2.64	485.6	379.2	591.9	2.0	1.63	2.54	28.1
Endocrine, nutritional and metabolic diseases	299.9	215.7	384.2	2.3	1.75	3.07	256.0	198.0	313.9	1.9	1.52	2.40	-43.9
Diseases of the genitourinary system	236.0	205.8	266.2	1.0	0.88	1.14	233.2	197.8	268.6	1.0	0.85	1.16	-2.8
Diseases of the musculoskeletal system and connective tissue	409.0	372.0	446.0	1.4	1.24	1.48	378.9	336.2	421.7	1.3	1.14	1.43	-30.1
Non-Indigenous males (excluding Quebec)													
All causes combined	4,682.9	4,659.0	4,706.7	...	...	...	4,491.1	4,461.4	4,520.8	...	...	...	-191.8 [§]
Diseases of the digestive system	647.9	641.2	654.7	...	...	...	605.1	596.8	613.4	...	...	...	-42.8 [§]
Diseases of the respiratory system	467.6	460.1	475.1	...	...	...	456.5	447.3	465.6	...	...	...	-11.1
Injuries	539.7	533.9	545.4	...	...	...	497.3	490.3	504.3	...	...	...	-42.4 [§]
Diseases of the circulatory system	779.3	772.9	785.6	...	...	...	695.2	687.4	703.0	...	...	...	-84.1 [§]
Mental and behavioural disorders	202.6	197.7	207.5	...	...	...	238.3	230.0	246.6	...	...	...	35.7 [§]
Endocrine, nutritional and metabolic diseases	129.6	125.4	133.8	...	...	...	134.3	129.2	139.4	...	...	...	4.7
Diseases of the genitourinary system	236.3	232.9	239.8	...	...	...	234.2	229.7	238.8	...	...	...	-2.1
Diseases of the musculoskeletal system and connective tissue	302.3	298.8	305.9	...	...	...	295.9	291.3	300.5	...	...	...	-6.4

... not applicable

[§] The CIs for the rate difference do not overlap.

a. Hospitalization rates were age-standardized using the direct method based on the age structure of the national Indigenous population from the 2011 CanCHEC (both sexes combined, Quebec excluded).

b. The reference group for RRs is the non-Indigenous population (same sex, same cohort). An RR can be said to be significant if its CI does not include zero.

c. DAD data are not available for Quebec.

d. Causes of hospitalization are based on the most responsible diagnosis.

g. To make 2006 CanCHEC rates comparable to 2011 CanCHEC rates, only census subdivisions that were considered to be reserves in both 2006 and 2011 were classified as "on reserve."

Notes: ASHR = Age-standardized hospitalization rates. RR = Rate ratios. CanCHEC = Canadian Census Health and Environment Cohort. CI = Confidence interval. DAD = Discharge Abstract Database. Collective dwellings were excluded from the 2006 CanCHEC to make rates comparable to the 2011 CanCHEC. Collective dwellings refer to dwellings of a commercial, institutional or communal nature. Collective dwellings also include rooming or lodging houses, hotels, motels, tourist homes, nursing homes, hospitals, staff residences, communal quarters of military camps, work camps, jails, missions, group homes, and so on. Collective dwellings may be occupied by usual residents or solely by foreign or temporary residents. A sampling weight was applied to make the cohort more representative of the target population and to reduce bias because of missed links. Generalized bootstrap weights were derived from the final cohort weight. Bootstrap replicate weights were used to estimate appropriate standard errors and 95% CIs.

Sources: 2006 and 2011 Canadian Census Health and Environment Cohorts (2006 Census data linked to 2006/2007-to-2010/2011 DAD records, and 2011 National Household Survey data linked to 2011/2012-to-2015/2016 DAD records).

All-cause hospitalizations

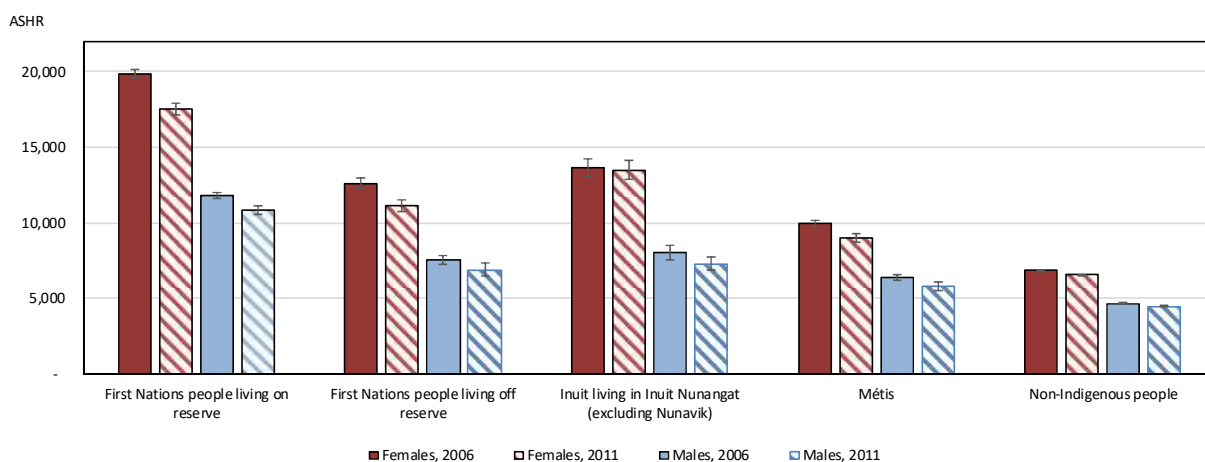
ASHRs for all-cause hospitalizations were consistently and significantly (no CI overlap) higher among Indigenous people than among non-Indigenous people, and this was true for females and males from both the 2006 and the 2011 CanCHECs (Figure 1). The most elevated RRs for all-cause ASHRs were among First Nations females and males living on reserve from both cohorts. For example, in the 2011 cohort, the ASHR of First Nations females living on reserve was 2.7 times that of non-Indigenous females (17,523 versus 6,539 per 100,000 population), and the ASHR of First Nations males living on reserve was 2.4 times that of non-Indigenous males (10,840 versus 4,491 per 100,000 population). RRs among First Nations females and males living off reserve in the 2011 cohort were 1.7 and 1.5, respectively; among Inuit females and males, 2.1 and 1.6; and among Métis females and males, 1.4 and 1.3.

Rate differences indicated that all-cause ASHRs were generally lower among the 2011 cohort compared with the 2006 cohort, and this was true for Indigenous and non-Indigenous females and males. CIs overlapped for Inuit females and males and for First Nations males living off reserve, but trends were in the same direction. First Nations females and males living on reserve showed the largest decrease in all-cause ASHRs from 2006 to 2011. RRs significantly (no CI overlap) decreased over time for First Nations females living on and off reserve.

First Nations people living on reserve

Among females, the top 3 causes of hospitalization were pregnancy, digestive causes and injuries in the 2011 cohort and pregnancy, digestive causes and respiratory causes in the 2006 cohort (Figure 2). Some cause-specific ASHRs significantly decreased from 2006 to 2011—this was the case for

Figure 1
All-cause age-standardized acute-care hospitalization rates per 100,000 population, by population group and sex, Canada, excluding Quebec, 2006 and 2011 Canadian Census Health and Environment Cohorts



Notes: ASHR = Age-standardized acute-care hospitalization rate. Births are included for females.
Sources: 2006 and 2011 Canadian Census Health and Environment Cohorts.

hospitalizations related to pregnancy, digestive causes, respiratory causes, circulatory causes, endocrine causes, musculoskeletal causes and injuries. First Nations females living on reserve presented the largest disparities with non-Indigenous females across the most ICD-10-CA chapters in both the 2006 and the 2011 cohorts (Figure 3). In the 2011 cohort, the largest RRs were for hospitalizations related to endocrine causes (RR=4.0), respiratory causes (RR=3.7), mental health (RR=3.4), injuries (RR=3.3), digestive causes (RR=3.0), genitourinary causes (RR=2.6), pregnancy (RR=2.4) and circulatory causes (RR=2.1).

Among males, the top 3 causes of hospitalization were injuries, digestive causes and respiratory causes in both the 2011 and the 2006 cohorts. ASHRs significantly decreased from 2006 to 2011 for respiratory causes, digestive causes, circulatory causes and injuries. In the 2011 cohort, the ICD-10-CA chapters that had the largest disparities with non-Indigenous males were endocrine causes (RR=5.2), mental health (RR=4.1), injuries (RR=3.1), respiratory causes (RR=2.6) and digestive causes (RR=2.3).

There was a significant increase in ASHRs from 2006 to 2011 for mental health-related hospitalizations for both First Nations females and males living on reserve.

First Nations people living off reserve

Among First Nations females living off reserve, the top 3 causes of hospitalization were pregnancy, digestive causes and injuries in the 2011 cohort and pregnancy, digestive causes and respiratory causes in the 2006 cohort. ASHRs for pregnancy and digestive causes significantly decreased from 2006 to 2011. In the 2011 cohort, the causes that had the largest disparities with non-Indigenous females were mental health (RR=3.0),

endocrine causes (RR=2.3), respiratory causes (RR=2.1), injuries (RR=2.0) and digestive causes (RR=1.9).

Among males, the top 3 causes of hospitalization were injuries, digestive causes and circulatory causes in both cohorts, albeit in a different order. ASHRs significantly decreased from 2006 to 2011 for respiratory causes. The causes of hospitalization with the most elevated RRs in the 2011 cohort were mental health (RR=2.8) and endocrine causes (RRs=2.3).

Inuit in Inuit Nunangat (excluding Nunavik)

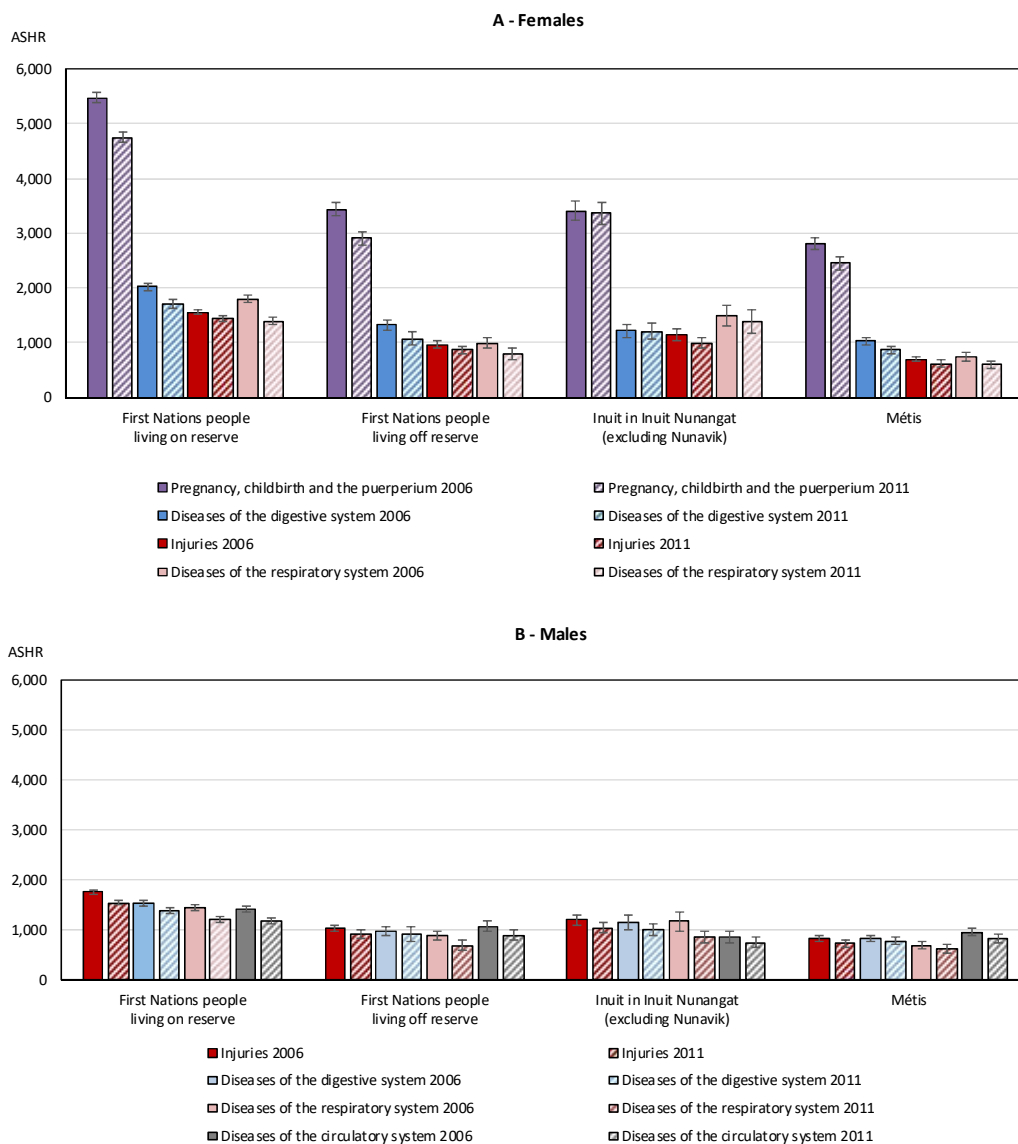
Among Inuit females, the top 3 causes of hospitalization were pregnancy, respiratory causes and digestive causes in both cohorts. All CIs for cause-specific ASHRs overlapped for Inuit females, but trends were generally in the same (decreasing) direction from 2006 to 2011. In the 2011 cohort, the causes that had the largest disparities with non-Indigenous females were respiratory causes (RR=3.6), injuries (RR=2.3), mental health (RR=2.2) and digestive causes (RR=2.1).

Among males, the top 3 causes of hospitalization were injuries, digestive causes and respiratory causes in both cohorts, albeit in a different order. All CIs for cause-specific ASHRs overlapped for Inuit males, but trends were generally in the same (decreasing) direction from 2006 to 2011. In the 2011 cohort, the causes that had the largest disparities with non-Indigenous males were mental health (RR=3.1), injuries (RR=2.1) and respiratory causes (RR=1.9).

Métis

Among Métis females, the top 3 causes of hospitalization were pregnancy, digestive causes and injuries in the 2011 cohort and pregnancy, digestive causes and respiratory causes in the 2006 cohort. There was a significant decrease in ASHRs from 2006 to 2011 for hospitalizations related to pregnancy, digestive

Figure 2
Age-standardized acute-care hospitalization rates per 100,000 population for top 3 causes, by Indigenous group and sex, Canada, excluding Quebec, 2006 and 2011 Canadian Census Health and Environment Cohorts



Note: ASHR = Age-standardized hospitalization rate.
Sources: 2006 and 2011 Canadian Census Health and Environment Cohorts.

causes and respiratory causes. The causes of hospitalization with the most elevated RRs in the 2011 cohort were endocrine causes and mental health (both RRs=1.9).

Among males, the top 3 causes of hospitalization were circulatory causes, digestive causes and injuries in both cohorts, albeit in a different order. All CIs for cause-specific ASHRs overlapped for Métis males, but trends were generally in the same (decreasing) direction from 2006 to 2011. The causes of hospitalization with the most elevated RRs in the 2011 cohort were mental health (RR=2.0) and endocrine causes (RR=1.9).

Discussion

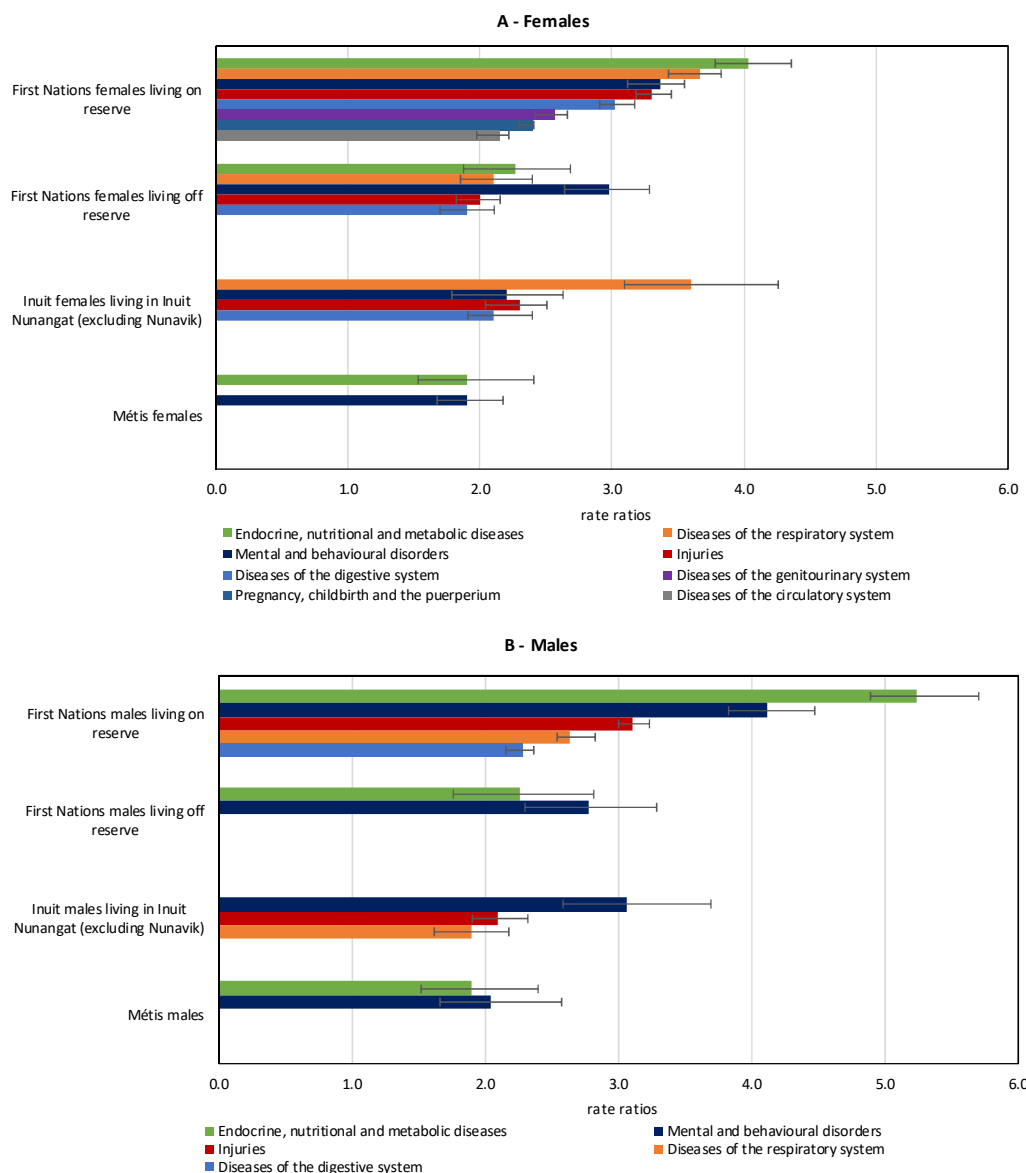
Overall, ASHRs were higher among First Nations people, Inuit living in Inuit Nunangat and Métis compared with the non-Indigenous population: this was true for females and males from both the 2006 and the 2011 CanCHECs. The greatest disparities with the non-Indigenous population were observed among First Nations females and males living on reserve from both cohorts. These findings are consistent with previous national linked data research.¹⁷

This study further compared two cohorts over two time periods. Although more time points are needed to perform formal statistical testing to establish clear trends, overall hospitalization rates were lower in the 2011 CanCHEC than in the 2006 cohort, and this was true for Indigenous and non-Indigenous females and males. First Nations females and males living on reserve showed the largest decrease in all-cause hospitalization rates from 2006 to 2011.

The current study described sex differences. The ranking of leading causes of hospitalization varied for females and males, emphasizing the importance of examining hospitalizations separately by sex. Among females, the leading cause of

hospitalizations for all groups, including non-Indigenous females, was pregnancy, childbirth and the puerperium. This reflects administrative policy—i.e., many healthy pregnant women are sent to hospitals for the birthing process. However, analyses at the sub-chapter level of complications of labour and delivery yielded the same results (data not shown). Diseases of the digestive system (First Nations females living on and off reserve, Métis females) and diseases of the respiratory system (Inuit females) were the next leading causes of hospitalization in both cohorts. Among males, the leading cause of hospitalization for Métis was diseases of the circulatory system, while for First Nations people (living on and off reserve) and Inuit, it was injuries. It was beyond the scope of this study to

Figure 3
Highest rate ratios for age-standardized acute-care hospitalization rates, by Indigenous group and sex, Canada, excluding Quebec, 2011 Canadian Census Health and Environment Cohort



Note: The reference group for the rate ratios is the non-Indigenous population of the same sex.
Source: 2011 Canadian Census Health and Environment Cohort.

examine intentional and unintentional injuries separately. Future research could investigate this chapter in more detail, while providing important context for sensitive issues such as assaults and self-harm.

In terms of disparities, hospitalizations for endocrine, nutritional and metabolic diseases had the largest RRs for First Nations females and males living on reserve, with rates four and five times higher than for the non-Indigenous population. This is consistent with previous research¹⁷ and with the known disproportionate burden of diabetes among First Nations people in Canada.²⁴⁻²⁷ Many systemic factors contribute to type 2 diabetes in the Indigenous population.²⁸ Socioeconomic disadvantage impacts levels of stress and limits healthy choices in terms of diet, physical activity or adherence to medication.²⁴ Individuals living in remote communities may also lack access to complete health services and information about diabetes.²⁶

Diseases of the respiratory system had the largest disparity for Inuit females, with rates 3.6 times those of non-Indigenous females. Respiratory diseases are a key cause of death among the female population in Inuit Nunangat, contributing to differences in life expectancy with the rest of Canada.²⁹ Inuit children experience some of the highest rates of respiratory infection in the world.³⁰ Smoking is a known risk factor for respiratory diseases,³¹ and smoking rates are high among Inuit. In 2012, 63% of Inuit aged 15 and older in Inuit Nunangat reported that they smoked cigarettes daily, compared with 16% of the total population.³² Other environmental factors, such as household crowding and poor ventilation, contribute to respiratory infection among Inuit.³³

Hospitalizations for mental health showed the largest disparities with non-Indigenous people for First Nations females and males living off reserve, Métis males, and Inuit males, with rates two to three times higher. This is consistent with previous research.¹⁷ In addition, rates of mental and behavioural disorders were higher in the 2011 cohort than in the 2006 cohort for First Nations females and males living on reserve. Note that the DAD underestimates hospitalizations for mental and behavioural disorders, as the province of Ontario reports to another system.

Several factors may contribute to the higher hospitalization rates for mental health among Indigenous people. The intergenerational trauma caused by residential schools, the forced relocation of communities and the forced removal of children from their families are factors that have heightened risks for mental illnesses and psychological distress.^{15,34-35} More generally, higher hospitalization rates may also reflect less access and more barriers to primary care services, especially in remote areas, including Inuit Nunangat.³⁶⁻⁴⁰ As well, Indigenous people experience racism and discrimination in the health care system.⁴¹⁻⁴² It was beyond the scope of this study to explore the reasons behind the different hospitalization patterns among Indigenous people; future research is warranted to better understand these findings.

Future research may also explore hospitalization patterns among other Indigenous groups not covered in this study, such as Inuit living in urban centres and people with Registered Indian status. Finally, because inequalities in social determinants of health may also influence hospitalization rate disparities, future research may benefit from deploying a multivariate analysis approach to better understand the relationships between hospitalization patterns and sociodemographic characteristics among Indigenous peoples.

Strengths and limitations

The CanCHEC datasets have many strengths. They fill an information gap by linking individual-level national administrative health data (that lack ethnocultural identifiers) with individual-level data from the census long-form questionnaire and the NHS that contain these identifiers. As a result, administrative health outcomes can be examined across characteristics such as Indigenous identity. In addition, the CanCHECs have a large sample size and extended follow-up periods, which allow for the examination of health outcomes for smaller populations, such as First Nations people, Inuit and Métis.

The following limitations should be considered. Rates in this study represent linked CanCHEC members from the non-institutional (or household) population who experienced selected health conditions, who received care in an acute-care hospital during the follow-up periods and who had a discharge that was linked. Patterns of hospital use as captured in the DAD are not generalizable to patterns of use for all types of hospitalizations (e.g., day surgery, psychiatric services).

The findings are not generalizable to Quebec since hospitalization data from that province were not available in the DAD. Also, since 2005, Ontario has reported mental health hospitalizations in the Ontario Mental Health Reporting System.⁴³ Therefore, acute-care mental health hospitalizations in Ontario are underreported, and the rates seen for mental disorders in this study represent an underestimate.

The study's findings are not generalizable to institutionalized populations, the homeless population and people living in collective dwellings, as well as to CSDs whose on-reserve status was not the same in 2006 and 2011. CSDs and individuals excluded from the analytic sample could have an unknown impact on the results.

Another limitation is that this study did not account for transfers between hospitals. In remote communities, transfers between institutions for the same episode of care may be more common, and this can confound the results. However, transfers of care do reflect increased use of health service resources.

Caution should be exercised when data on Indigenous populations are compared across census and NHS cycles.⁴⁴ Differences between the cycles include changes to the wording and format of questions on self-reported Indigenous identity, legislative changes (which affect concepts such as Indigenous

identity and Registered Indian status), changes made to the definition of reserves, and differences in methodology and in the list of incompletely enumerated reserves. In addition, some people, for a variety of reasons, report their Indigenous identity differently from one data collection period to another.

While only two points in time were compared, the data reported herein serve as a baseline, and more years of CanCHECs can be added to the analysis as the data become available.

Conclusion

In its call to action 19, the Truth and Reconciliation Commission (TRC) of Canada has called upon the federal government to publish data and assess long-term trends for a number of health indicators for Indigenous people. This study

presents new, standardized data on acute-care hospitalizations among Indigenous people in 2006 and 2011, using a sex-specific and distinctions-based approach. The disproportionate burden of hospitalizations among Indigenous people, specifically those attributable to endocrine, nutritional and metabolic diseases, as well as mental and behavioural disorders, points to the need for considering every hospital admission as an important opportunity for intervention and prevention. The TRC of Canada has recognized that the poorer health outcomes of Indigenous people in Canada are rooted in the ongoing legacies of colonization; future research should continue to investigate the social and historical determinants of health among Indigenous people.

Appendix A

Hospitalizations grouped by ICD-10-CA codes using most responsible diagnosis

Causes of hospitalization	Abbreviation in the text	Codes
All causes combined (births included)	...	All causes
All causes combined (births excluded)	...	All causes, excluding any diagnosis code of O10 to O16, O21 to O29, O30 to O46, O48, O60 to O75, O85 to O92, O95, or O98 to O99, with a sixth digit of 1 or 2 coded in any position or Z37 coded in any position
Pregnancy, childbirth and the puerperium	Pregnancy	Chapter 15 O00-O99
Diseases of the digestive system	Digestive causes	Chapter 11 K00-K93
Diseases of the respiratory system	Respiratory causes	Chapter 10 J00-J99
Diseases of the circulatory system	Circulatory causes	Chapter 9 I00-I99
Mental and behavioural disorders	Mental health	Chapter 5 F00-F99
Endocrine, nutritional and metabolic diseases	Endocrine causes	Chapter 4 E00-E90
Diseases of the genitourinary system	Genitourinary causes	Chapter 14 N00-N99
Diseases of the musculoskeletal system and	Musculoskeletal causes	Chapter 13 M00-M99
Injuries	Injuries	Chapter 19 S00-T98

... not applicable

Source: Canadian Institute for Health Information, *International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada* (ICD-10-CA).

Appendix B

Canadian Census Health and Environment Cohort without collective dwellings (2006) linked to Discharge Abstract Database (2006/2007 to 2010/2011), by population group, sex, age group and jurisdiction, Canada, excluding Quebec

	Total (excluding Quebec)	First Nations people living on reserve (excluding Quebec)	First Nations people living off reserve (excluding Quebec)	Inuit living in Nunangat (excluding Nunavik)	Métis (excluding Quebec)	Non- Indigenous people (excluding Quebec)
Total cohort	4,439,880	190,465	71,755	25,795	75,535	4,040,690
Percentage of total cohort	100	4	2	1	2	91
Sex						
Female	2,261,150	93,835	38,240	12,780	38,020	2,060,175
Male	2,178,730	96,635	33,515	13,015	37,515	1,980,515
Age group (years)						
0 to 9	529,020	41,955	14,780	6,040	12,250	447,110
10 to 19	621,750	42,895	15,180	6,065	14,825	535,720
20 to 29	555,065	27,360	10,295	4,255	11,305	496,765
30 to 39	603,075	25,470	10,270	3,575	10,665	548,410
40 to 49	736,315	24,015	10,015	2,865	11,815	682,560
50 to 59	618,720	15,075	6,460	1,665	8,400	583,675
60 to 69	385,165	8,480	2,975	865	4,065	366,820
70 to 79	259,085	3,970	1,355	370	1,715	250,595
80 and older	131,685	1,250	430	95	495	129,035
Jurisdiction						
Newfoundland and Labrador	96,405	1,185	1,820	1,950	2,715	87,180
Prince Edward Island	24,035	370	130	...	60	23,455
Nova Scotia	167,550	7,030	1,300	...	1,360	157,595
New Brunswick	136,075	6,010	955	...	765	128,100
Ontario	2,167,525	28,080	20,445	...	13,600	2,094,260
Manitoba	244,960	47,460	8,170	...	14,230	173,410
Saskatchewan	213,285	40,305	10,150	...	12,275	149,470
Alberta	601,305	30,215	11,465	...	17,645	540,625
British Columbia	728,155	29,805	13,275	...	10,220	666,730
Yukon	12,125	...	1,815	...	315	8,225
Northwest Territories	23,325	...	2,140	2,760	2,235	7,830
Nunavut	25,135	...	90	21,085	115	3,805
Total hospitalizations	1,763,500	144,300	37,860	13,035	35,850	1,511,250
Percentage of total hospitalizations	100	8	2	1	2	86

... not applicable

Notes: Discharge Abstract Database (DAD) data are not available for Quebec. To make the 2006 Canadian Census Health and Environment Cohort (CanCHEC) comparable to the 2011 CanCHEC, only census subdivisions that were considered to be reserves in both 2006 and 2011 were classified as "on reserve." Collective dwellings were excluded from the 2006 CanCHEC to make it comparable to the 2011 CanCHEC. Collective dwellings refer to dwellings of a commercial, institutional or communal nature. Collective dwellings also include rooming or lodging houses, hotels, motels, tourist homes, nursing homes, hospitals, staff residences, communal quarters of military camps, work camps, jails, missions, group homes, and so on. Collective dwellings may be occupied by usual residents or solely by foreign or temporary residents.

Source: 2006 Canadian Census Health and Environment Cohort (2006 Census data linked to 2006/2007-to-2010/2011 DAD records).

Appendix C

Canadian Census Health and Environment Cohort (2011) linked to Discharge Abstract Database (2011/2012 to 2015/2016), by population group, sex, age group and jurisdiction, Canada, excluding Quebec

	Total (excluding Quebec)	First Nations people living on reserve (excluding Quebec)	First Nations people living off reserve (excluding Quebec)	Inuit living in Inuit Nunangat (excluding Nunavik)	Métis (excluding Quebec)	Non- Indigenous people (excluding Quebec)
Total cohort	4,900,320	193,795	89,785	22,620	80,275	4,492,415
Percentage of total cohort	100	4	2	0	2	92
Sex						
Female	2,503,975	96,090	47,630	11,170	40,980	2,296,910
Male	2,396,345	97,710	42,155	11,450	39,295	2,195,510
Age group (years)						
0 to 9	571,960	42,845	17,230	5,245	12,215	490,705
10 to 19	626,760	39,675	18,065	4,540	14,530	546,110
20 to 29	618,635	29,345	13,285	4,135	12,025	556,820
30 to 39	637,245	23,560	11,690	2,820	10,740	585,990
40 to 49	747,620	24,145	12,270	2,715	11,885	693,755
50 to 59	737,230	18,265	9,420	1,685	10,315	694,860
60 to 69	523,265	10,105	5,095	980	5,655	499,725
70 to 79	289,030	4,505	2,115	415	2,225	278,920
80 and older	148,570	1,350	620	85	685	145,525
Jurisdiction						
Newfoundland and Labrador	93,175	1,495	3,115	2,060	2,410	81,810
Prince Edward Island	23,195	340	170	...	85	22,565
Nova Scotia	169,005	7,880	2,140	...	1,880	156,710
New Brunswick	136,380	5,735	1,430	...	865	128,055
Ontario	2,401,690	26,365	26,465	...	15,870	2,326,120
Manitoba	257,915	47,630	8,110	...	14,130	187,505
Saskatchewan	206,070	38,280	7,735	...	10,250	149,330
Alberta	697,670	35,260	11,580	...	19,590	629,190
British Columbia	861,940	30,810	17,500	...	12,840	793,155
Yukon	9,160	...	2,715	...	250	6,120
Northwest Territories	22,610	...	8,730	2,510	2,005	8,625
Nunavut	21,510	...	100	18,055	100	3,230
Total hospitalizations	1,848,400	136,215	41,780	11,520	34,370	1,613,000
Percentage of total hospitalizations	100	7	2	1	2	87

... not applicable

Notes: Discharge Abstract Database (DAD) data are not available for Quebec. To make the 2006 Canadian Census Health and Environment Cohort (CanCHEC) comparable to the 2011 CanCHEC, only census subdivisions that were considered to be reserves in both 2006 and 2011 were classified as "on reserve."

Source: 2011 Canadian Census Health and Environment Cohort (2011 National Household Survey data linked to 2011/2012-to-2015/2016 DAD records).

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