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^{p} preliminary
^{r} revised
x suppressed to meet the confidentiality requirements of the *Statistics Act*
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Acute care hospitalization of Aboriginal children and youth

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Abstract

Background: Research that has examined Aboriginal children's hospitalization rates at the national level has been limited to analyses of areas with large percentages of Aboriginal residents, rather than of Aboriginal individuals. This study uses linked census and administrative data to describe hospitalization patterns among children and youth aged 0 to 19, by Aboriginal identity, for all provinces and territories except Quebec.

Data and methods: The 2006 Census was linked to the 2006/2007-to-2008/2009 Discharge Abstract Database, which contains hospital records from all acute care facilities (except Quebec). Hospital records were examined by Aboriginal identity, as reported to the census, according to International Classification of Diseases chapters based on "the most responsible diagnosis." Age-standardized hospitalization rates (ASHRs) were calculated per 100,000 population, and age-standardized rate ratios (RRs) were calculated for Aboriginal groups relative to non-Aboriginal people.

Results: ASHRs were consistently higher among Aboriginal children and youth relative to their non-Aboriginal counterparts; rates for children aged 0 to 9 were 1.3 to 1.8 times higher; for youth aged 10 to 19, 2.0 to 3.8 times higher. For all children aged 0 to 9, the leading cause of hospitalization was "diseases of the respiratory system," but RRs for Aboriginal children ranged from 1.7 to 2.5, compared with non-Aboriginal children. Disparities between Aboriginal and non-Aboriginal 10- to 19-year-olds were pronounced for injuries due to assaults (RRs from 4.8 to 10.0), self-inflicted injuries (RRs from 2.7 to 14.2), and pregnancy, childbirth and the puerperium (RRs from 4.1 to 9.8).

Interpretation: Additional research is needed to examine reasons for the disparities in hospitalization rates between Aboriginal and non-Aboriginal children and youth.

Keywords: Assault, First Nations, Inuit, Métis, respiratory, self-inflicted injury

Research has shown less favourable health outcomes for Aboriginal children and youth compared with their non-Aboriginal contemporaries.[1-6] Analyses of provincial administrative data have also found higher rates of hospitalization for young Aboriginal people.[7-13] Two studies[7,8] reported an elevated rate of hospitalization for injury (intentional and unintentional) among children in areas with higher percentages of Aboriginal residents for all of Canada (excluding Quebec). However, geographic approaches tend to underestimate hospitalizations among subpopulations.[14]

Information about hospitalization rates among Aboriginal children is needed to document causes and disparities, and to better understand resource use and service requirements. This study provides national counts (excluding Quebec) of acute care hospitalizations and the leading diagnoses for Aboriginal and non-Aboriginal children (ages 0 to 9) and youth (ages 10 to 19). Data are presented for First Nations people living on and off reserve, Métis, and Inuit living in Inuit Nunangat. The analysis is based on socio-demographic information (including Aboriginal identity) from the 2006 Census that was linked to hospital discharge records.[15]

Data and methods

Data sources

Data from the 2006 Census[16] for nine provinces (excluding Quebec) and the three territories were linked to the Canadian Institute for Health Information's 2006/2007-to-2008/2009 Discharge Abstract Database (DAD). Long-form census respondents (about 20% of the non-institutional population) provided detailed socio-demographic information, including Aboriginal identity.[16] As well, rather than sampling households, all households in Nunavut, the Northwest Territories (excluding Yellowknife), Yukon (excluding Whitehorse), and all Indian reserves and settlements were asked to complete the long-form questionnaire.

Every year, the DAD consolidates about 3 million hospital records from all acute care facilities and some psychiatric, chronic rehabilitation, and day surgery facilities in Canada,[17-19] except Quebec. Because of that exclusion, residents of Quebec (including Inuit in Nunavik) are not represented in the linked data, nor are hospitalizations in Quebec of residents of other provinces and territories.

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Hierarchical deterministic linkage was conducted using identifiers common to both the census and the DAD: date of birth, sex, and postal code. A validation study concluded that the linked file is suitable for health-related research and is broadly representative of the population of Canada.[15]

An important limitation is the lower rate of census coverage, and also, eligibility to link to the DAD, for groups relevant to this analysis: individuals who identified as Aboriginal, children younger than age one, and youth aged 15 to 19.[15] Lower coverage means that Aboriginal children and youth tend to be underrepresented. Statistics Canada estimates that 10.6% of Aboriginal people living on reserve were missed by the 2006 Census.[20] About 94% of non-Aboriginal census respondents were eligible for linkage, compared with 89% of First Nations respondents, 93% of Métis respondents, and 92% of Inuit respondents. The likely impact is underestimation of hospitalization rates of Aboriginal children and youth and a possible downward bias. Because ages of the cohort were not adjusted (that is, "aged") across the three years of combined hospital data, hospitalization rates for certain conditions are more likely underestimated, for example, respiratory-related among youth for some age-specific strata.

Linkage was conducted in accordance with the *Directive on Record Linkage*[21] and approved by Statistics Canada's Executive Management Board.[22] Details about the linkage methodology are available elsewhere.[15]

Statistics Canada ensures respondent privacy during linkage and subsequent use of linked files.[21] Only employees directly involved in the process have access to the unique identifying information (such as name and sex) required for linkage and do *not* access health-related information. When linkage is completed, an analytical file is created from which identifying information has been removed. Analysts are given access only to this de-identified file.

Aboriginal identity

The 2006 Census question on Aboriginal identity was: "Is this person an Aboriginal person, that is, North American Indian, Métis, or Inuit (Eskimo)?" The household member who completed the census responded for each household member and marked all that applied. Answers were classified as: North American Indian (only), Métis (only), Inuit (only), other Aboriginal (multiple or indeterminate), or non-Aboriginal. The present analysis includes only single-identity respondents; about 3% of the Aboriginal identity population reported other Aboriginal (multiple or indeterminate) identities[23] and were excluded.

The geographical location of census respondents was used to identify Inuit in Inuit Nunangat and First Nations people living on reserve (Indian reserves or settlements) or off reserve. Inuit counts are provided only for Inuit Nunangat, comprising the communities in the four Inuit land claim regions: Nunatsiavut (northern coastal Labrador), Nunavik (Northern Quebec), the territory of Nunavut, and the Inuvialuit Settlement Region of the Northwest Territories. Inuit Nunangat represents 78% of the total Inuit population. Inuit counts for this analysis exclude those in Nunavik because hospital discharges were not available for Quebec. As a result, 9,565 Inuit (19% of the total Inuit population, 24% of total Inuit in Nunangat)[23] were excluded.

The 2006 Census on-reserve population comprises residents of any of eight census subdivision (CSD) types legally affiliated with First Nations Indian bands, as well as other types of CSDs in northern Saskatchewan, the Northwest Territories, and the Yukon that have large concentrations of First Nations people. "On reserve" comprises legally defined Indian reserves, Indian settlements, other land types created by ratification of Self-Government Agreements, and other northern communities affiliated with First Nations according to criteria established by Indigenous and Northern Affairs Canada.

This study pertains to First Nations living on reserve, First Nations living off reserve, Métis, Inuit in Inuit Nunangat (excluding Nunavik), and the non-Aboriginal population. "Aboriginal" refers to members of these four Aboriginal groups; "Inuit" refers to Inuit in Inuit Nunangat excluding Nunavik.

What is already known on this subject?

- Previous studies based on geographic approaches have shown that Aboriginal children and youth experience less favourable health than non-Aboriginal children and youth.
- Geographic approaches tend to underestimate hospitalizations among subpopulations, because of omissions, misclassifications, and other errors.

What does this study add?

- This study examines national hospitalization rates (excluding Quebec) of Aboriginal children and youth at the individual level.
- Age-standardized hospitalization rates were consistently higher among Aboriginal children and youth relative to their non-Aboriginal contemporaries.
- The leading cause of hospitalization for both Aboriginal and non-Aboriginal 0- to 9-year-olds was conditions related to diseases of the respiratory system, but rates were higher for Aboriginal children.
- Disparities in hospitalization rates between Aboriginal and non-Aboriginal 10- to 19-year-olds were apparent for conditions related to intentional injuries (self-inflicted and assaults) and to pregnancy, childbirth, and the puerperium.

Hospitalization

The frequency of hospitalization by diagnostic category/chapter, based on "the most responsible diagnosis," was compiled for each Aboriginal group and for non-Aboriginal children and youth. Individuals could be represented more than once if they were hospitalized multiple times during the 2006/2007-to-2008/2009 period.

Acute care DAD hospital discharge records linking to eligible long-form census respondents were classified based on the person's census-reported Aboriginal identity and geographic location rather than the province where the submitting hospital was located. This enabled inclusion of hospitalizations that occurred in a province different from the respondent's province/territory of residence at the time of the 2006 Census.

Most responsible diagnosis

Each hospital discharge record contains up to 25 diagnoses based on the *International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Canada* (ICD-10-CA).[24] The "most responsible diagnosis," which is the most significant diagnosed condition and/or accounts for the longest length of stay, was used to sort hospital records into chapters pertaining to specific diseases or injuries, etiology of the disease, conditions specific to body systems, or conditions and situations that are risk factors.[25] The first three characters of each most responsible diagnosis were used to classify hospitalizations by chapter. In accordance with previously used methods,[7,8,10,26] hospitalizations for injuries were categorized as unintentional or intentional injuries; intentional injuries among 10- to 19-year-olds were divided into assaults and self-inflicted injuries.

A frequency ranking was first applied to all in-scope linked census–DAD records to determine the most common diagnoses. The highest-ranking chapter codes, in addition to hospitalizations for all chapters combined, with and without pregnancy and child-birth-related hospitalizations, were selected to report hospitalization rates for each Aboriginal group and for non-Aboriginal children and youth.

Analytical techniques

Age-standardized hospitalization rates (ASHRs) per 100,000 population, age-standardized rate ratios (RRs) and 95% confidence intervals were calculated for each Aboriginal group and for the non-Aboriginal population. To reduce wide variations that can occur with small numbers, discharge records for the three fiscal years linked to 2006 Census long-form respondents were combined.

ASHRs used the sum of linked hospitalizations for a given identity group as numerators, divided by the denominator—unweighted person counts from the Census study cohort for the same identity group, multiplied by three

Table 1
Age-standardized† acute care hospitalization rates (ASHRs) per 100,000 children, by Aboriginal identity and cause, non-institutionalized population aged 0 to 9, Canada excluding Quebec, 2006/2007 through 2008/2009

	Total Canada			First Nations living on reserve			First Nations living off reserve			Métis			Inuit living in Inuit Nunangat (excluding Nunavik)			Non-Aboriginal population		
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
Cause	ASHR	from	to	ASHR	from	to	ASHR	from	to	ASHR	from	to	ASHR	from	to	ASHR	from	to
All causes combined	523	518	528	839	819	859	646	615	679	644	609	682	666	617	719	478	473	483
Diseases of digestive system	52	51	54	76	70	83	53	45	63	56	46	67	70	55	88	49	48	51
Injuries‡	56	54	58	109	102	117	81	71	93	83	71	97	92	75	113	48	46	50
Unintentional injuries	47	46	49	97	90	104	66	56	77	71	60	84	79	63	98	40	38	41
Diseases of respiratory system	139	136	141	288	277	300	203	186	221	194	175	215	255	225	288	117	114	119
Diseases of circulatory system	5	5	5	8	6	10	7	4	11	6	4	11	x	x	x	5	4	5
Mental and behavioural disorders	5	4	5	3	2	5	5	3	9	5	3	10	x	x	x	5	4	5
Endocrine, nutritional and metabolic diseases	12	11	12	12	10	15	11	8	16	13	9	19	x	x	x	12	11	12
Diseases of genitourinary system	15	14	16	28	25	32	24	18	30	24	18	32	x	x	x	13	12	14
Diseases of musculoskeletal system and connective tissue	10	10	11	13	10	15	13	10	19	12	8	18	17	11	27	10	9	11

x suppressed to meet confidentiality requirements of Statistics Act
† standardized to Aboriginal population age structure (both sexes combined) based on 2006 Census of Canada
‡ because of suppression guidelines, counts of hospitalizations for intentional injuries not shown
Sources: 2006 Census of Canada; Discharge Abstract Database 2006/2007, 2007/2008, 2008/2009 combined.

(number of DAD years). Age standardization used the direct method, based on the age structure of the Aboriginal population according to the 2006 Census.

Age-standardized 95% confidence intervals for the ASHRs and RRs were derived with the Spiegelman method.[27] The non-Aboriginal population was the reference for RRs.

Results

All-cause hospitalization rates

Age-standardized acute care hospitalization rates among Aboriginal children and youth consistently surpassed those of their non-Aboriginal contemporaries. At ages 0 to 9, the overall hospitalization rate was highest for First Nations children living on reserve (839 per 100,000), which was 1.8 times that for non-Aboriginal children (478 per 100,000) (Table 1). Compared with non-Aboriginal 0- to 9-year-olds, rates were 1.4 times higher for First Nations living off reserve, 1.3 times higher for Métis, and 1.4 times higher for Inuit in Inuit Nunangat.

Among 10- to 19-year-olds, the overall hospitalization rate (including births) was highest for Inuit in Inuit Nunangat (1,866 per 100,000), which was 3.8 times that for non-Aboriginal youth (497 per 100,000) (Table 2). The rate was almost as high (1,806 per 100,000) for First Nations youth living on reserve—3.6 times that for non-Aboriginal youth. Rates for First Nations youth living off reserve and Métis youth were 2.3 and 2.0 times higher, respectively, than rates for non-Aboriginal youth. When hospitalizations related to births were excluded, overall rates at ages 10 to 19 were reduced but remained well above those for non-Aboriginal youth: 2.6 times higher for Inuit, 2.5 times higher for First Nations living on reserve, 1.8 times higher for First Nations living off reserve, and 1.6 times higher for Métis.

Leading causes

At ages 0 to 9, the top three causes of hospitalization were the same for each Aboriginal group and for non-Aboriginal children. The leading cause was "diseases of the respiratory system." The second leading cause for children in all Aboriginal groups was "injuries, poisoning and other consequences of

Table 2
Age-standardized† acute care hospitalization rates (ASHRs) per 100,000 youth, by Aboriginal identity and cause, non-institutionalized population aged 10 to 19, Canada excluding Quebec, 2006/2007 through 2008/2009

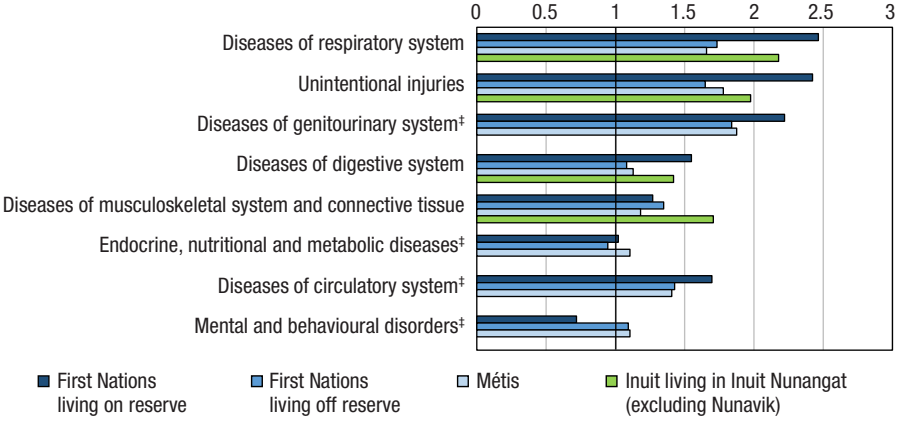
	Total Canada			First Nations living on reserve			First Nations living off reserve			Métis			Inuit living in Inuit Nunangat (excluding Nunavik)			Non-Aboriginal population		
		95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval			95% confidence interval	
Cause	ASHR	from	to	ASHR	from	to	ASHR	from	to	ASHR	from	to	ASHR	from	to	ASHR	from	to
All causes combined (births included)	643	638	649	1,806	1,776	1,837	1,131	1,088	1,175	977	936	1,020	1,866	1,780	1,955	497	492	502
All causes combined (births excluded)	489	485	494	1,059	1,036	1,083	741	707	777	647	613	682	1,089	1,024	1,157	417	413	422
Pregnancy, childbirth and the puerperium	153	150	155	737	718	757	387	363	414	326	303	352	775	720	833	79	77	81
Diseases of digestive system	81	79	83	136	128	145	83	72	95	100	87	114	119	99	143	75	73	77
Injuries	105	103	107	259	248	271	174	157	191	151	136	169	282	250	318	85	83	87
Unintentional injuries	69	67	71	141	133	150	92	81	105	95	83	109	138	116	164	60	58	62
Intentional injuries	22	21	23	94	88	102	62	52	73	44	36	54	132	111	157	12	12	13
Assaults	10	10	11	52	47	57	36	29	45	25	19	33	31	21	44	5	5	6
Intentional self-harm	12	11	12	42	38	47	26	20	33	20	14	27	101	83	124	7	7	8
Diseases of respiratory system	42	41	44	99	92	107	74	64	86	61	52	73	82	66	102	35	34	36
Diseases of circulatory system	8	8	9	13	11	16	9	6	14	5	3	9	x	x	x	8	7	9
Mental and behavioural disorders	61	60	63	147	139	156	120	107	135	91	79	105	214	186	246	49	47	50
Endocrine, nutritional and metabolic diseases	16	15	17	28	25	32	23	18	30	14	10	20	x	x	x	15	14	16
Diseases of genitourinary system	21	20	22	42	38	47	36	29	45	36	28	45	32	22	46	18	18	19
Diseases of musculoskeletal system and connective tissue	20	19	21	22	19	26	25	19	32	21	16	29	16	10	26	20	19	21

x suppressed to meet confidentiality requirements of Statistics Act
† standardized to Aboriginal population age structure (both sexes combined) based on 2006 Census of Canada
Sources: 2006 Census of Canada; Discharge Abstract Database 2006/2007, 2007/2008, 2008/2009 combined.

external causes," followed by "diseases of the digestive system; among non-Aboriginal children, these causes ranked third and second.

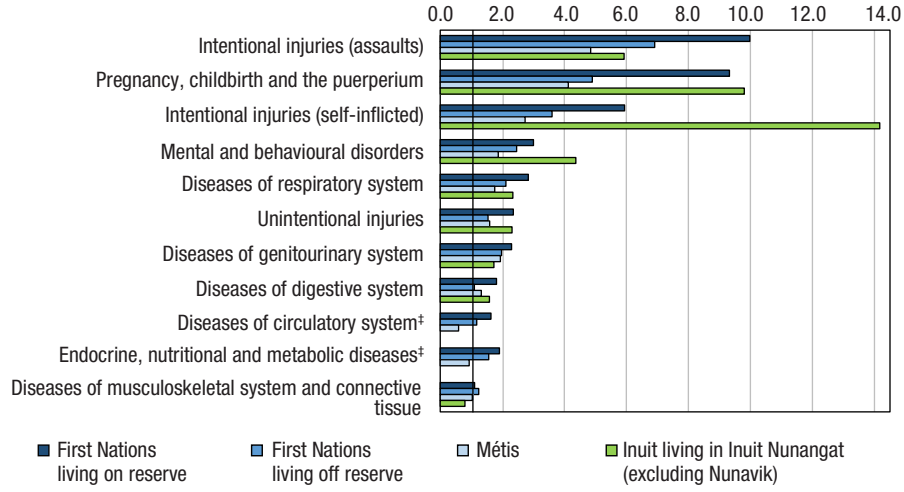
For 10- to 19-year-olds in each Aboriginal group, the leading cause of hospitalization was "pregnancy, childbirth, and the puerperium," followed by "injuries, poisoning and other consequences of external causes." For non-Aboriginal youth, the ranking of these two causes was reversed. The third leading cause of hospitalization for First Nations (living on or off reserve) and Inuit youth was "mental and behavioural disorders." For Métis and non-Aboriginal youth, "diseases of the digestive system" ranked third.

Figure 1
Rate ratios† for age-standardized acute care hospitalization rates per 100,000 non-institutionalized population aged 0 to 9, by Aboriginal identity and cause, Canada excluding Quebec, 2006/2007 through 2008/2009



† reference group (vertical line) is non-Aboriginal population
‡ owing to small sample sizes, rates not calculated for Inuit children
Note: Ratios based on unrounded rates with decimals.
Sources: 2006 Census of Canada; Discharge Abstract Database 2006/2007, 2007/2008 and 2008/2009 combined.

Figure 2
Rate ratios† for age-standardized acute care hospitalization rates per 100,000 non-institutionalized population aged 10 to 19, by Aboriginal identity and cause, Canada excluding Quebec, 2006/2007 through 2008/2009



† reference group (vertical line) is non-Aboriginal population
‡ owing to small sample sizes, rates not calculated for Inuit children
Note: Ratios based on unrounded rates with decimals.
Sources: 2006 Census of Canada; Discharge Abstract Database 2006/2007, 2007/2008 and 2008/2009 combined.

Rate ratios for children aged 0 to 9

At ages 0 to 9, the greatest disparities from non-Aboriginal hospitalization rates were among First Nations living on reserve, whose rate ratios were more than twice as high for "diseases of the respiratory system" (RR = 2.5), "unintentional injuries" (2.4), and "diseases of the genitourinary system" (2.2) (Figure 1).

For First Nations children living off reserve, the highest RRs were for "diseases of the genitourinary system" (1.8), "diseases of the respiratory system" (1.7), and "unintentional injuries" (1.6). The ranking and magnitude of RRs for Métis children were similar: "diseases of the genitourinary system" (1.9), "unintentional injuries" (1.8), and "diseases of the respiratory system" (1.7).

Among Inuit children, RRs for the top two conditions were similar to those for First Nations children living on reserve: "diseases of the respiratory system" (2.2) and "unintentional injuries" (2.0). Owing to the small sample size, RRs could not be reported for diseases of the genitourinary system; diseases of the endocrine, nutritional and metabolic systems; diseases of the circulatory system; and mental and behavioural disorders.

Rate ratios for youth aged 10 to 19

For First Nations 10- to 19-year-olds living on reserve, the highest RR was for "intentional injury (assaults)," with a rate 10.0 times that for non-Aboriginal youth (Figure 2). The next highest RRs were for "pregnancy, childbirth, and the puerperium" (9.3), "intentional injuries (self-inflicted)" (5.9), and "mental and behavioural disorders" (3.0).

RRs for First Nations youth living off reserve were lower, but the ranking was the same: "intentional injuries (assaults)" (6.9), "pregnancy, childbirth, and the puerperium" (4.9), "intentional injuries (self-inflicted)" (3.6), and "mental and behavioural disorders" (2.5).

For Métis youth, this ranking persisted: "intentional injuries (assaults)" (4.8), "pregnancy, childbirth and the puerperium" (4.1), "intentional injuries (self-inflicted)" (2.7), and "mental and behavioural disorders" (1.9).

For Inuit youth, rate ratios tended to be high, and the rank order differed. The highest RR was 14.2 for "intentional injuries (self-inflicted)," followed by "pregnancy, childbirth and the puerperium" (9.8), "intentional injuries (assaults)" (5.9), and "mental and behavioural disorders" (4.4).

Discussion

According to results from the 2006 Census-DAD linkage, Aboriginal children and youth were more likely than their non-Aboriginal contemporaries to be hospitalized. For 0- to 9-year-olds, overall age-standardized hospitalization rates were about 1.5 times higher. At ages 10 to 19, rates were 2.0 to 3.8 times higher. Rates were generally highest for First Nations living on reserve and for Inuit in Inuit Nunangat. These differences demonstrate the importance of examining hospitalization of children and youth for each Aboriginal group.

The leading cause of hospitalization at ages 0 to 9 was "diseases of the respiratory system" for each Aboriginal group and for non-Aboriginal children. However, First Nations children living on reserve and Inuit children were more than twice as likely as non-Aboriginal children to have been hospitalized for this reason. Housing conditions such as crowding and poor indoor air quality have been associated with respiratory problems among Aboriginal children and adults.[5,28]

In the present analysis, "pregnancy, childbirth, and the puerperium" ranked high as a cause of hospitalization among First Nations, Métis, and Inuit youth. This is consistent with research showing that Aboriginal women are more likely than non-Aboriginal women to be teen mothers.[29,30] Teen motherhood has implications not only for the use of health care services, but also for educational and economic outcomes,[29] and has been associated with poorer physical and mental health of children.[31,32,33]

The widest differences in hospitalization rates between Aboriginal and non-Aboriginal 10- to 19-year-olds were for intentional injuries: assaults among First Nations and Métis, and self-inflicted injuries among Inuit. Analyses that used geographic approaches also found elevated rates of unintentional injuries among children and of intentional injuries among youth in areas with higher percentages of Aboriginal residents.[7,8] Provincial studies, too, reported higher rates of both intentional[12] and unintentional[10,12,34,35] injuries among Aboriginal children and youth. The high rate ratio for self-inflicted injuries among Inuit (14.2) reinforces the need for health prevention strategies.

Disparities in hospitalization rates between Aboriginal and non-Aboriginal children were apparent for "diseases of the genitourinary system," particularly for First Nations living off reserve and Métis, although the overall number of hospitalizations was relatively small. In children, problems of the urinary system include acute and chronic kidney failure, urinary tract infections, obstructions along the urinary tract, and abnormalities present at birth.[36]

High rates of hospitalization for Aboriginal children and youth may be associated with factors that were not taken into account in the present study and warrant consideration in future analyses. For instance, some differences could be related to less favourable socioeconomic conditions for Aboriginal children and youth.[37] The results could also reflect differences in access and barriers to care.[38] As well, differences in intentional injuries and mental disorders have been attributed to intergenerational effects of residential schools.[34,35]

Limitations

Several limitations should be considered when interpreting the results. The lack of data for Quebec and for residents of 22 incompletely enumerated reserves suggests possible underestimation. In addition, mental health hospitalizations in Ontario were not comprehensively reported to the DAD, but instead, to the Ontario Mental Health Reporting System. Also, the census-DAD linked data under-represent children younger than age one. For these reasons, studies using other datasets are warranted.

The analyses were based on counts of hospitalizations and do not consider readmissions or reflect the number of persons hospitalized. Research exploring readmissions would be valuable in understanding resource use and health promotion strategies.

Although hospitalizations of children and youth do not place the largest burden on the health care system (about one-fifth of all hospitalizations[39]), they are important for long-term health and use of health care services.

Hospitalizations are a limited indicator of health status. These results cannot be interpreted as representing the prevalence of health conditions or injuries.

Conclusion

Unlike area-based estimates, this study presents national (excluding Quebec) information on acute care hospitalization of Aboriginal children and youth at the individual level. Age-standardized hospitalization rates were consistently higher among each Aboriginal identity group relative to non-Aboriginal children and youth. Future research could examine reasons for these disparities and how the rates and reasons vary by factors such as gender and geographic location.

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