

# Injury in First Nations Communities in Ontario

Daniel Fantus, MSc, MD,<sup>1</sup> Baiju R. Shah, MD, PhD,<sup>1-4</sup> Feng Qiu, MSc,<sup>2</sup> Janet Hux, MD, SM, MSc,<sup>1-4</sup>  
Paula Rochon, MD, MPH<sup>1,2,4</sup>

## ABSTRACT

**Background:** High and variable rates of injury have been reported in Aboriginal communities in Canada. This has not been well studied for specific injury types. We sought to compare the rate and categories of injuries leading to hospital admission among those in First Nations communities relative to those living in small northern and southern communities in Ontario.

**Methods:** Administrative data were used to define the study populations. The incidence of all-cause injury and specific injury categories for residents living in Ontario's Aboriginal communities (N=28,816) was determined for 2004 using hospital discharge data. Comparisons were made with residents of small communities in northern (N=211,834) and southern Ontario (N=650,002). Age- and sex-adjusted rates were calculated.

**Results:** All-cause-injury age- and sex-adjusted rates were 2.5 times higher for those living in First Nations communities compared to those living in northern communities. Relative risks (RR) for specific injury types in First Nations compared with northern communities were: assault (RR=5.5 in females and 4.8 in males), intentional self-harm (RR=5.9 in females and 5.2 in males) and accidental poisoning (RR=4.9 in females and 3.7 in males). Differences were also seen between northern and southern communities: assault (RR=2.8 in females and 3.5 in males), intentional self-harm (RR=2.1 in females and 1.4 in males) and accidental poisoning (RR=2.2 in females and 1.7 in males).

**Discussion:** Injuries severe enough to require a hospital admission were higher in First Nations communities in northern Ontario relative to those in northern and southern Ontario communities. Higher rates of certain injuries were also noted in northern compared with southern communities. This underscores the importance of using a geographic comparison group.

**Key words:** Epidemiology; poisoning; injuries

La traduction du résumé se trouve à la fin de l'article.

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Canada is ranked third internationally on the United Nations' Human Development Index, but people living in northern Aboriginal communities do not always receive the health benefits that should follow the equitable distribution of this wealth.<sup>1</sup> While considerable effort has been made, Canada's Aboriginal population (i.e., First Nations, Métis, and Inuit) continues to have a lower health status than the national population.<sup>2,3</sup>

Injury is the leading cause of death among Aboriginal communities while it is the third leading cause of death among Canadians as a whole.<sup>4</sup> In the United States and Australia, the rate of hospitalization and death due to injury is two to three times greater in the indigenous population.<sup>5,6</sup> Furthermore, high injury rates are associated with poverty and alcoholism and disproportionately affect young people.<sup>7-10</sup>

Most injuries do not result in death but instead lead to morbidity. Despite the importance of morbidity related to injuries, the frequency and type of injuries leading to hospitalization among those living in Canada's Aboriginal communities have not been well studied.<sup>3</sup> Our goal was to explore injury-related morbidity by comparing the incidence and categories of injuries severe enough to require an acute care hospital admission among those living in First Nations compared to small communities located in northern and southern Ontario.

## METHODS

### Study population

The study and comparison populations were defined as the entire populations of groups of communities, using the approach out-

lined by Shah et al.<sup>11</sup> The Aboriginal population was defined as the residents of all communities in northern Ontario identified in the census as being *Indian reserves or settlements*. Just under 96% of the people living in these communities report having a First Nations identity and Aboriginal origins.<sup>12</sup> We limited our study to First Nations communities in northern Ontario as, of the 151 Indian reserves and settlements in Ontario, 127 are in the North. Because these communities are small and isolated, we selected the residents of all non-Aboriginal communities with populations <10,000 from northern Ontario as a geographic comparison group. We selected the residents of all non-Aboriginal communities with populations <10,000 in southern Ontario as an additional comparison group. Northern Ontario, based on the federal government's definition, comprises the Greater Sudbury Division and the following districts:

### Author Affiliations

1. Department of Medicine, University of Toronto, Toronto, ON
2. Institute for Clinical Evaluative Sciences, Toronto, ON
3. Sunnybrook Health Sciences Centre, Toronto, ON
4. Department of Health Policy, Management and Evaluation, University of Toronto, Toronto, ON

**Correspondence:** Dr. Daniel Fantus, Internal Medicine Residency Training Program, McGill University, Royal Victoria Hospital, Room M10.02, 687 Pine Avenue West, Montreal, QC H3A 1A1, E-mail: daniel.fantus@mail.mcgill.ca

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**Table 1.** Description of the First Nations, Northern and Southern Communities

		Communities		
		First Nations N=28,816	Northern N=211,834	Southern N=650,002
Sex	Female	13,901 (48.2%)	104,512 (49.3%)	321,898 (49.5%)
	Male	14,915 (51.8%)	107,322 (50.7%)	328,104 (50.5%)
Age	Mean (SD)	28(20)	39(22)	39.5(22)
	Children (0-14 years)	9353 (32.4%)	36,910 (17.4%)	118,374 (18.2%)
	Youth (15-24 years)	4940 (17.1%)	27,432 (12.9%)	83,829 (12.9%)
	Adults (25-64 years)	12,734 (44.1%)	116,166 (54.8%)	345,177 (53.1%)
	Older Adults (65 and older)	1789 (6.4%)	31,326 (14.8%)	102,622 (15.8%)

**Table 2.** Age- and Sex-adjusted Rate per 1,000 and Relative Risk Comparing Injury Categories and All-cause Injury in the Southern, Northern and First Nations Communities

Injury Categories	Age and Sex-adjusted Rate			Relative Risk		
	First Nations	Northern	Southern	First Nations vs. Northern	Northern vs. Southern	First Nations vs. Southern
Accidental Falls	5.7	4.0	3.6	1.4	1.1	1.6
Accidental Poisoning	5.8	1.3	0.6	4.5	2.0	9.0
Assault	1.7	0.3	0.1	5.7	3.3	18.0
Burns	0.2	0.1	0.1	2.0	1.4	2.2
Event of Undetermined Intent	0.8	0.2	0.1	4.0	2.0	9.8
Exposure to Physical Forces	1.8	1.1	0.9	1.6	1.2	1.9
Intentional Self-harm	5.1	0.9	0.5	5.7	1.8	9.7
Motor Vehicle Accidents	1.4	1.1	1.1	1.3	1.0	1.2
Toxic Effects of Substances	0.4	0.2	0.2	2.0	1.3	2.9
<b>All-cause Injury</b>	<b>19.4</b>	<b>7.9</b>	<b>6.5</b>	<b>2.5</b>	<b>1.2</b>	<b>3.0</b>

Kenora, Rainy River, Thunder Bay, Algoma, Cochrane, Manitoulin, Sudbury, Timiskaming, Nipissing and Parry Sound.<sup>12</sup>

### Data source

We used two linked databases for our study: the *Registered Persons Data Base* (RPDB) and the *Canadian Institute for Health Information Hospital Discharge Abstract Database* (CIHI-DAD). The RPDB lists demographic information (age, sex and home postal code to identify community of residence) for all Ontario residents. The CIHI-DAD is an administrative database detailing all hospital discharges. The records include a list of discharge diagnoses recorded using the International Classification of Diseases, Tenth Edition (ICD-10) codes.<sup>13</sup> Residents are linked between databases using a unique, anonymous identifying number. Although health care services for Aboriginal people living on reserves are under federal jurisdiction, admissions to Ontario hospitals would still be captured in the provincial administrative databases. However, people living in the extreme northwestern part of the province may be transferred to Manitoba for their acute care, and these hospitalizations would be missed.

Demographic information was obtained from the RPDB by extrapolating RPDB postal codes from Statistics Canada's census division codes. We determined age and sex for each individual in our cohorts. We used four age groups: children (up to 14 years); youth (15 to 24 years); adults (25 to 64 years); and older adults (65 years and older), as has been done in a previous report on injuries.<sup>7</sup>

### Rate determination

All-cause injury was defined as an acute care hospital admission for an injury in one of nine categories using ICD-10 codes, as described in Appendix 1. We also examined each injury category separately. Each patient's hospital admission injury diagnosis code was attributed to that patient's community of residence regardless of where the hospitalization occurred. Aboriginal communities generally do not have acute care hospitals but have nursing stations that manage less severe trauma. More severe trauma cases are transferred, often by air, to an acute care hospital.

The incidence rate of all-cause injury per 1,000 people was calculated by age group and sex for each population. Numerators were determined by counting the frequency of hospital discharges bearing ICD-10 codes describing injury in 2004. Multiple hospital discharges for the same individual were counted as separate events. The rate denominator was the population obtained from RPDB data for each of the three groups of communities. Because those living in Aboriginal communities are younger than those living in non-Aboriginal communities, we adjusted for age and sex using indirect standardization.

Relative risk was calculated for each injury category using the northern communities as the reference category. Relative risk using the southern communities was also calculated for comparison. Additionally we compared rates in northern and southern communities. All statistical analyses were performed using statistical software SAS version 9.

Research ethics approval was obtained from Sunnybrook Health Sciences Centre, Toronto, ON.

### RESULTS

Our cohort included 28,816 people living in First Nations communities, 211,834 living in northern, and 650,002 living in southern communities. The age and sex distribution of these populations is outlined in Table 1. The mean age of the southern and northern communities was 39 years (SD=22) compared to a mean age of 28 years (SD=20) for those living in First Nations communities.

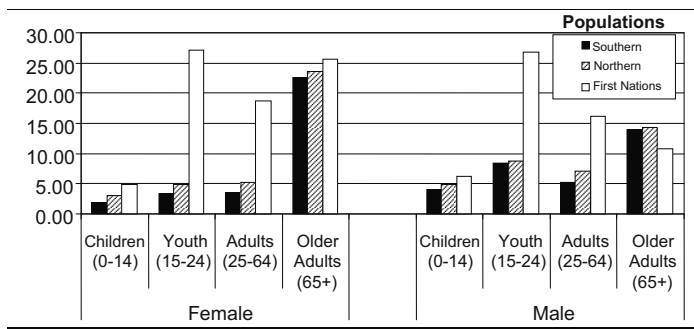
### All-cause injury rates

The age- and sex-adjusted incidence rate of all-cause injury was 19.4 per 1,000 for the First Nations communities, versus 7.9 per 1,000 for the northern communities and 6.5 per 1,000 for the southern communities (see Table 2). The relative risk for injury in the First Nations communities was 2.5 relative to the northern communities while it was 3.0 relative to the southern communities. The all-cause injury rates were the most different between the First Nations and the northern communities in youth and adults (see Figure 1).

**Table 3.** Age-adjusted Rate per 1,000 and Relative Risk Comparing Injury Categories and All-cause Injury in the Southern, Northern and First Nations Communities by Sex

Injury Categories	Age-adjusted Rate						Relative Risk					
	First Nations		Northern		Southern		First Nations vs. Northern		Northern vs. Southern		First Nations vs. Southern	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
Accidental Falls	8.0	3.9	4.8	3.2	4.3	2.9	1.7	1.2	1.1	1.1	1.9	1.3
Accidental Poisoning	8.3	3.3	1.7	0.9	0.8	0.5	4.9	3.7	2.2	1.7	11.1	6.2
Assault	1.1	2.4	0.2	0.5	0.1	0.1	5.5	4.8	2.8	3.5	20.3	17.4
Burns	0.1	0.3	0.1	0.2	0.0	0.1	1.0	1.5	1.9	1.3	2.3	2.2
Event of Undetermined Intent	0.9	0.8	0.2	0.1	0.1	0.1	4.5	8.0	2.2	1.8	9.6	10.0
Exposure to Physical Forces	1.1	2.5	0.6	1.7	0.5	1.4	1.8	1.5	1.2	1.2	2.3	1.7
Intentional Self-harm	7.1	3.1	1.2	0.6	0.6	0.5	5.9	5.2	2.1	1.4	12.5	6.5
Motor Vehicle Accidents	1.0	1.7	0.6	1.6	0.8	1.5	1.7	1.1	0.8	1.1	1.3	1.2
Toxic Effects of Substances	0.3	0.6	0.1	0.2	0.1	0.2	3.0	3.0	1.2	1.3	2.5	3.1
<b>All-cause Injury</b>	<b>24.2</b>	<b>16.1</b>	<b>7.9</b>	<b>8.0</b>	<b>6.3</b>	<b>6.7</b>	<b>3.1</b>	<b>2.0</b>	<b>1.2</b>	<b>1.2</b>	<b>3.8</b>	<b>2.4</b>

**Figure 1.** The age-specific rate per 1000 of all-cause injury by gender among Southern, Northern and First Nations communities in Ontario in 2004



**Injury categories**

The age- and sex-adjusted incidence rates for the different categories of injury are also shown in Table 2. All categories of injury were more common in the First Nations communities. The three most frequent categories of injury resulting in hospitalization for those living in First Nations communities were accidental poisoning, accidental falls, and intentional self-harm. The highest relative risks for the First Nations and northern communities comparison were seen for assault, intentional self-harm, and accidental poisoning (see Table 2).

The age-adjusted rate of injury by category and all-cause injury was analyzed by sex in the three groups (see Table 3). The rates of all-cause injury were slightly higher in males than in females in the non-Aboriginal communities. In contrast, the all-cause injury rate was higher in females than in males in the First Nations communities. The injury categories leading to hospital admission differed between females and males. The relative risks (RR) for specific injury types in First Nations compared with northern communities were: assault (RR=5.5 in females and 4.8 in males), intentional self-harm (RR=5.9 in females and 5.2 in males) and accidental poisoning (RR=4.9 in females and 3.7 in males). Differences were also seen between northern and southern communities: assault (RR=2.8 in females and 3.5 in males), intentional self-harm (RR=2.1 in females and 1.4 in males) and accidental poisoning (RR=2.2 in females and 1.7 in males).

**DISCUSSION**

Our study demonstrates that the risk of injury severe enough to result in a hospital admission were higher for those living in First Nations communities compared to those in northern communities. Similar findings have been documented in other Canadian provinces such as Saskatchewan and Alberta.<sup>4,14</sup>

In addition, our study found that members of First Nations communities were more likely to be hospitalized for assault, intentional self-harm, and accidental poisoning compared to those in non-Aboriginal communities. The rates for females were higher than for males in these First Nations communities.

Motor vehicle accidents were only slightly increased in those living in First Nations communities compared to those in northern communities. This is in contrast with findings from the Calgary Health Region.<sup>14</sup> This discrepancy may be due to the nature of the communities studied, since Aboriginal communities are quite isolated, with 15% having no year-round road access.<sup>2</sup>

Unlike previous studies, our study directly compares injury patterns in First Nations communities with those in communities from the general population as geographic controls. As seen in Table 2, the overall relative risk of injury because of geography (i.e., comparing northern vs. southern communities) is elevated to a very modest extent (about 20%). However, for some specific injury types (assault, accidental poisoning and intentional self-harm), the relative risk values were close to 2 and above. This underscores the importance of controlling for geographic factors when analyzing the risks of specific types of injury in Aboriginal communities. These data suggest that factors other than remoteness may play a role in predisposing to injuries.<sup>2,15,16</sup>

Our study identifies females in First Nations communities as being especially vulnerable to injury. Based on our data, assault, intentional self-harm and accidental poisoning among Aboriginal females appear to be major problems. Our data might be explained by the fact that female intentional injuries are more likely to lead to acute hospitalization than male injuries. Violence and sexual assault have been previously documented within Aboriginal female populations in Canada and Australia.<sup>17-21</sup>

While this study provides a detailed documentation of hospitalizations for injury for residents of First Nations communities, there are limitations. First, our work does not reflect the population living off-reserve. However, Aboriginal people likely represent a small group of the population of rural northern non-Aboriginal communities, so their influence on the injury rates in these communities is likely small. Second, we are defining First Nations status ecologically, based on residency in a northern Aboriginal community. However, about 4% of the population of these communities is non-Aboriginal, who would be misclassified in this study. Finally, by using hospitalizations for injuries, we do not capture injuries that are less severe and treated within the community. Most Aboriginal communities have nursing stations where many injuries are treated, reducing the need for hospitalization. Some severe injuries

**Appendix 1.** Injury Categories and Associated ICD-10 Codes

Injury Categories	ICD-10 Code	Examples of Frequent Injuries Included in the Category
Accidental Falls	W00-W19	Fall from slipping, tripping and stumbling
Accidental Poisoning	T36-T50, X40-X44	Accidental poisoning by non-opioid analgesics and antipyretics Accidental poisoning by antiepileptic, sedative-hypnotic and antiparkinsonism drugs
Assault	X85-X99, Y00-Y09	Assault by bodily force Assault by sharp object
Burns	T20-T32	Burn of second degree Burn of third degree
Event of Undetermined Intent	Y10-Y34	Poisoning by antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs, undetermined intent Poisoning by narcotics and psychodysleptics [hallucinogens], undetermined intent
Exposure to Physical Forces	W20-W99, X00-X39	Struck by thrown, projected or falling object Striking against or struck by/in non-sports
Intentional Self-harm	X60-X84	Intentional self-poisoning by antiepileptic, sedative-hypnotic, antiparkinsonism and psychotropic drugs Intentional self-poisoning by non-opioid analgesics, antipyretics and antirheumatics
Motor Vehicle Accidents	V01-V99	Driver of other all-terrain or other off-road motor vehicle injured in non-traffic accident Car occupant injured in collision with car, pickup truck or van, driver, traffic accident
Toxic Effects of Substances	T51-T65, X45-X49	Toxic effect of alcohol Accidental poisoning by and exposure to other and unspecified chemicals and noxious substances

result in death outside of the hospital, and some injuries in the extreme northwestern part of the province may have resulted in hospitalizations in Manitoba. Accordingly, while our findings of injury rates were substantial, we may underestimate the true spectrum and magnitude of injuries experienced in the Aboriginal communities studied.

While our study focused on injury, chronic diseases such as heart disease and diabetes<sup>11,22,23</sup> and behaviours such as drinking and smoking are also high in Canada's Aboriginal communities.<sup>22</sup> With such major differences in health, governments need to assume greater responsibility. While money can be spent and resources allocated to address each health issue individually, it is the determinants of health (namely, income, living conditions, employment and education) that need our direct intervention.<sup>24</sup> It is by addressing these core issues through income reallocation and investing in education and housing that we will begin to see a reduction in health differences across many disease outcomes, including injury.

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**RÉSUMÉ**

**Contexte :** La population autochtone au Canada présente des risques élevés et variables de blessure, mais ce problème important n'a pas été étudié en profondeur pour certains types de blessures particulières. Nous cherchons à comparer le taux et les catégories de blessures menant à une hospitalisation chez les collectivités des Premières nations et les personnes vivant dans de petites collectivités du Sud et du Nord de l'Ontario.

**Méthodes :** Nous avons utilisé des données administratives pour déterminer les populations de l'étude. Nous avons déterminé l'incidence de toutes les catégories de causes-blessures et de blessures particulières concernant les personnes vivant dans les collectivités autochtones de l'Ontario (N=28 816) pour l'année 2004, en utilisant les données de congé d'hôpital. Nous avons comparé les personnes vivant dans de

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petites collectivités au Nord (N=211 834) avec celles vivant au sud (N=650 002) de l'Ontario. Nous avons calculé les taux ajustés selon l'âge et le sexe.

**Résultats :** Tous les taux de blessure ajustés selon l'âge et le sexe étaient 2,5 fois plus élevés chez les personnes vivant dans des collectivités des Premières nations que chez celles vivant dans des collectivités du Nord. Les risques relatifs (RR) pour certains types de blessures particulières chez les collectivités des Premières nations comparativement aux collectivités du Nord étaient les suivants : grand risque d'hospitalisation à la suite d'une agression (RR=5,5 chez les femmes et 4,8 chez les hommes), d'une blessure intentionnelle infligée à soi-même (RR=5,9 chez les femmes et 5,2 chez les hommes) et d'un empoisonnement accidentel (RR=4,9 chez les femmes et 3,7 chez les hommes). Des différences étaient également notables entre les collectivités du Nord et du Sud : grand risque d'hospitalisation à la suite d'une agression (RR=2,8 chez les femmes et

3,5 chez les hommes), d'une blessure intentionnelle infligée à soi-même (RR=2,1 chez les femmes et 1,4 chez les hommes) et d'un empoisonnement accidentel (RR=2,2 chez les femmes et 1,7 chez les hommes).

**Discussion :** Les blessures qui sont suffisamment graves pour nécessiter une hospitalisation étaient plus fréquentes chez les personnes vivant dans les collectivités des Premières nations du Nord de l'Ontario que chez celles vivant dans les collectivités du Sud et du Nord de l'Ontario. Des risques élevés de certaines blessures ont également été observés chez les personnes vivant dans les collectivités du Nord par rapport à celles vivant dans les collectivités du Sud. Cela montre l'importance d'utiliser un groupe de comparaison géographique.

**Mots clés :** Épidémiologie; empoisonnement; blessures



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