Fracture risk among First Nations people: a retrospective matched cohort study

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Abstract

Background: Canadian First Nations people have unique cultural, socioeconomic and health-related factors that may affect fracture rates. We sought to determine the overall and site-specific fracture rates of First Nations people compared with non-First Nations people.

Methods: We studied fracture rates among First Nations people aged 20 years and older (n = 32 692) using the Manitoba administrative health database (1987–1999). We used federal and provincial sources to identify ethnicity, and we randomly matched each First Nations person with 3 people of the same sex and year of birth who did not meet this definition of First Nations ethnicity (n = 98 076). We used a provincial database of hospital separations and physician billing claims to calculate standardized incidence ratios (SIRs) and 95% confidence intervals (CIs) for each fracture type based on a 5-year age strata.

Results: First Nations people had significantly higher rates of any fracture (age- and sex-adjusted SIR 2.23, 95% CI 2.18–2.29). Hip fractures (SIR 1.88, 95% CI 1.61–2.14), wrist fractures (SIR 3.01, 95% CI 2.63–3.42) and spine fractures (SIR 1.93, 95% CI 1.79–2.20) occurred predominantly in older people and women. In contrast, craniofacial fractures (SIR 5.07, 95% CI 4.74–5.42) were predominant in men and younger adults.

Interpretation: First Nations people are a previously unidentified group at high risk for fracture.

Table 1: Characteristics of and fracture incidence in First Nations cohort and age-matched non-First Nations control group

| Characteristic             | First Nations cohort | Control subjects |
|----------------------------|----------------------|------------------|
| Age, yr†                  |                      |                  |
| < 40                       | 21 949 (67.1)        | 65 847 (67.1)    |
| 40–59                      | 7 712 (23.6)         | 23 136 (23.6)    |
| ≥ 60                       | 3 031 (9.3)          | 9 093 (9.3)      |
| Sex, male                  | 16 069 (49.2)        | 48 207 (49.2)    |
| Follow-up, person-years    | 384 012              | 1 085 778        |
| No. of fractures           |                      |                  |
| Any site                   | 11 118 (34.0)        | 16 252 (16.6)    |
| Hip                        | 322 (1.0)            | 554 (0.6)        |
| Wrist                      | 497 (1.5)            | 492 (0.5)        |
| Spine                      | 618 (1.9)            | 933 (1.0)        |
| Craniofacial               | 2 408 (7.4)          | 1 397 (1.4)      |

*Unless stated otherwise.
†As of Dec. 31, 1987.
identification number, this data repository allows for the creation of a longitudinal record of a person’s health service use. The accuracy of these administrative data has been established for a wide range of clinical disorders, including outcomes following hip fracture.7,8 Each subject’s longitudinal health service record from Apr. 1, 1987, to Dec. 31, 1999, was assessed for the presence of any ICD-9-CM fracture code (ICD-9-CM 800–829). Vertebral fractures without cord injury (ICD-9-CM 805), wrist fracture (ICD-9-CM 813), hip fracture (ICD-9-CM 820–821) and craniofacial fractures (ICD-9-CM 800–804) were analyzed as specific subcategories. To enhance the specificity of this coding, wrist and hip fracture codes had to be accompanied by a physician claim for site-specific fracture reduction or fixation (either open or closed).

Fracture rates were calculated for each ethnicity, sex and 5-year age group as the number of people with fractures divided by the

Table 2: Standardized incidence ratios (SIRs) for fractures in the First Nations cohort compared with age-matched control group

| Fracture      | SIR (95% CI)       |
|---------------|--------------------|
|               | Men*               | Women*             | All†               |
| Hip           | 2.13 (1.68–2.63)   | 1.75 (1.41–2.05)   | 1.88 (1.61–2.14)   |
| Wrist         | 2.83 (2.29–3.39)   | 3.16 (2.68–3.79)   | 3.01 (2.63–3.42)   |
| Spine         | 1.75 (1.54–2.08)   | 2.12 (1.88–2.51)   | 1.93 (1.79–2.20)   |
| Craniofacial  | 4.89 (4.51–5.29)   | 5.48 (4.88–6.19)   | 5.07 (4.74–5.42)   |
| Any           | 2.19 (2.12–2.27)   | 2.26 (2.20–2.36)   | 2.23 (2.18–2.29)   |

Note: CI = confidence interval.

*Adjusted for age only.
†Adjusted for age and sex.

Fig. 1: Fracture rates among men (circles) and women (triangles) for any fracture and hip, craniofacial, wrist and spine fractures. 95% confidence interval bars are shown.
number of person-years of follow-up (expressed per 1000 person-years). Standardized incidence ratios (SIRs) with 95% confidence intervals (CIs) were calculated for each fracture type using the First Nations cohort with the non-First Nations cohort matched for sex and age. We adjusted by age and sex even though these were matching variables in the cohort selection because these demographic variables are known to be associated with fracture rates.

All significance tests were performed at $\alpha = 0.05$.

Results

The demographic characteristics and fracture incidence of the cohorts are summarized in Table 1. The age- and sex-matched cohort provided 384,012 person-years of follow-up and 1,085,778 person-years of follow-up in the matched control group. Among the age- and sex-matched First Nations cohort, 34.0% met the definition for a fracture, as compared with 16.6% of the control subjects. There were sufficient numbers of hip, wrist, spine and craniofacial fractures for site-specific analysis.

The men and women in the First Nations cohort experienced significantly higher fracture rates than the control subjects did. The risk for hip fracture and spine fracture was almost double among the First Nations cohort (Table 2). The relative rates for any fracture, wrist fracture and craniofacial fracture were even greater. Age was strongly associated with hip fractures, with very few hip fractures before age 60 and a rapid increase in later life for men and women in both cohorts (Fig. 1). The opposite relation was seen for craniofacial fractures, which were more frequent before age 60 and were predominant in men. Wrist fractures and spine fractures showed a clear age-related increase in women, but this effect was much less evident in men. When all fracture types were combined, among women there was a strong pattern of increasing risk with advancing age, whereas among men there was a bimodal U-shaped relation, with the lowest point at 55–60 years of age (Fig. 1).

Interpretation

We found a substantially increased fracture risk among Canadian First Nations people. This is consistent with other reports that show that ethnicity can affect fracture rates. For example, compared with white people, people of black and Asian ethnicity tend to exhibit a lower risk for hip fracture, whereas people from the Indian subcontinent may have more hip fractures.

A major limitation in relying on administrative health data is the inability to establish the factors responsible for the observed fracture rates. A higher rate of accidental and nonaccidental trauma among Canadian First Nations people clearly contributes to the observed increased risk for fractures, especially the very high rates of craniofacial fractures. The age-related increase in hip, wrist and spine fractures seen predominantly in women follows a different profile. These sex patterns are broadly similar to those reported from the General Practice Research Database in the United Kingdom, which showed a bimodal U-shaped relation in adult men with a progressive age-related increase in adult women. In this 10-year study, skull fractures were most prevalent among young men, whereas fractures of the femur or hip, vertebra, and radius or ulna increased with age and were experienced mostly by older women.

First Nations people also differed from the control subjects in terms of socioeconomic status, area of residence and prevalence of diabetes, each of which may affect fracture rates. Socioeconomic status has been identified as a factor in hip fractures. Hip fractures are also reported to be more common in urban areas and more northern latitudes. Diabetes is a significant risk factor for fractures, and any putative benefit of type 2 diabetes in terms of enhanced bone mass appear to be overwhelmed by other adverse consequences of this disorder.

Whether a higher prevalence of osteoporosis contributes to higher fracture rates among First Nations people in Manitoba is uncertain and would require studies designed to assess bone density. A cross-sectional study from the Sac and Fox Nation in rural Oklahoma reported that peak bone mass index may be higher among Native Americans and that the postmenopausal rate of bone loss may be greater than that among white women. A subgroup of participants in the Women’s Health Initiative who were of Native American ethnicity were found to have significantly reduced bone density of the spine and total body when compared with white people, although hip bone density was not reduced.

Our case definition for First Nations ethnicity relies on the national Status Verification System and the provincial Health Registry file. This definition is highly specific for First Nations ethnicity. Statistics Canada data from 1996 indicated that only 4% of the Manitoba Aboriginal population were non-Status First Nations people. The majority (63.5%) of the Manitoba Aboriginal population are Status First Nations people. Therefore, our study should be representative of Manitoba First Nations people. The largest non-Status Aboriginal group in Manitoba is the Métis, who account for 31.9% of the Aboriginal population in the province. The control subjects were much more ethnically diverse and more difficult to characterize. Canada census data indicate that most were of European extraction, but some Aboriginal people who do not meet the case definition for Status First Nations would also have been included. Any bias introduced would work against finding a difference, and therefore our rate ratio estimates are, if anything, possible underestimates.

In summary, the incidence of all fracture types among Manitoba First Nations people is considerably greater than that among non-First Nations people in the province. Although the pathophysiology underlying this finding remains to be clarified, we have been able to identify a group...
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