Although relatively uncommon, proximal radius and ulna fractures may result in a substantial amount of disability and subsequent functional impairment, including losses of range of motion and strength, as well as an inability to perform various activities of daily living. As with other orthopaedic injuries, concerted efforts to document the incidence of proximal radial and ulnar fractures may prove useful in order to improve upon treatment outcomes. Unfortunately, to date, the majority of epidemiologic literature on these fractures has been based upon research conducted without a well-defined study population. In turn, this may limit the ability to calculate the true incidence of proximal radius and ulna fractures. Additionally, these studies have employed a variety of classification systems in the description of the type and distribution of fractures, which may introduce observer error. Due to these conflicting observations of incidence and patterns of distribution of proximal radius and ulna fractures within the orthopaedic literature, an accurate assessment of the true epidemiology of these injuries is difficult.

Therefore, the goal of the present study was to determine the overall, age-specific, and sex-specific incidence of proximal radius and ulna fractures over a three-year period in a major Canadian urban centre. These estimates may be used as denominators in the calculation of outcome and complication rates for specific injuries. With the application of this information, orthopaedic educators, researchers, clinicians, and administrators can place greater emphasis on those injuries with poor outcomes or increased complications in order to better understand why such injuries do poorly, with the ultimate goal of improving treatment results.

METHODS
Prior to commencing the study, ethics approval was obtained from our Institutional Research Ethics Board. Eligible cases of proximal radius and ulna fractures in the study city over a three-year period (April 1, 2002 to March 31, 2005) were identified using a regional health records database. Prior to conducting the database search, ICD-10 codes for fractures of the proximal radius and ulna were identified and used to search for all cases containing at least one of the ICD-10 codes. In order to eliminate duplicates, cases were cross-referenced by personal health number, date of service, and type of injury. Patient addresses were used to ensure that patients resided within the study city at the time of injury. Cases originating from outside the city were excluded from the study.

Demographic data for each case, including the patient’s date of birth, date of injury, and gender were collected. These were used to calculate age- and gender-specific incidence rates, as well as for standardizing incidence rates to the Canadian population, from the 2001 census. All rates are reported as per 10,000 persons, and accompanied by the corresponding 95% confidence intervals.

Radiographs and chart documents were collected for each eligible case. Two manuscript authors, both practicing orthopaedic surgeons, reviewed the radiographs, and classified each fracture according to the AO Classification System. Each of the two radiograph reviewers classified each case independently, following which all cases were compared to identify any potential differences between the reviewers. In cases where the classification differed, the reviewers discussed the case in question, and agreed upon a final appropriate classification.

RESULTS
Over the 3-year study period, a total of 1,030 patients (507 males, 523 females; mean age = 43.8±17.5 years) with a fracture of the proximal radius or ulna were identified. The most common fracture types observed were B2.1 (simple articular fracture of radius, n=374), B1.1 (unifocal articular fracture of ulna, n=280), and A2.2 (simple extra-articular fracture of neck of radius, n=145). Images of these fracture types are included in Figure 1.

The overall incidence of proximal radius and ulna fractures was 5.09 per 10,000 persons per year (95%CI: 4.78 to 5.40), while the age-adjusted incidence was 5.14 (95%CI: 5.05 to 5.23). Males and females had similar incidences (5.07 vs. 5.11, respectively). Based on AO classification, the incidence of fracture was similar for all age groups between 18 and 79 years of age (incidences ranging from 4.62 to 5.53). In comparison, the 80+ year-old cohort showed an increase in incidence (8.70, 95%CI: 6.24 to 11.16). The fracture counts, according to AO group, age, and gender are displayed in Figure 2. AO fracture types are presented as aggregates of type A (extraarticular fracture of one/both bones), B (articular fracture of one both with/without extraarticular fracture of the other), and C (articular fracture of both bones).

DISCUSSION
To our knowledge, this study is the first comprehensive North American population-based study to present the incidence of proximal radius and ulna fractures utilizing expertise-based classification. Our results highlight the most common fracture types seen, and well as the similarities in rates between genders. It is worth noting that the rate of proximal radius and ulna fractures sharply increases among persons 80 years and older. Although injury mechanism was not captured as part of our methodology, this increase may be due to falls, which are prevalent among elderly persons. The information presented in this study highlights the relative magnitude of the clinical burden of various types of fractures. In turn, many questions are raised about the clinical outcomes of such injuries. The incidence rates presented provide a population-based denominator that may be used for future research on outcomes and complications, allowing for a better estimation of the percentages of positive and negative outcomes and of complications.

SIGNIFICANCE
We identified an overall age-adjusted rate of 5.09 proximal radius/ulna fractures per 10,000 persons per year. To our knowledge, this is the first study to provide an estimate of population-based incidence of such fractures in a North American urban centre.