



Secular trends and population differences in the incidence of epilepsy. A population-based study from Saskatchewan, Canada



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ABSTRACT

Purpose: To estimate the incidence of epilepsy in Saskatchewan, Canada between 2005 and 2010 by using provincial administrative health database stratifying gender, age, self-reported Registered Indian (RI) status and secular trends.

Methods: An epilepsy database was created through linkage of services claims data from the provincial health database of Saskatchewan, Canada between 2005 and 2010 with a four years washout period (2001–2004). The algorithm used was at least two physician visit with the diagnosis of epilepsy on a different date within 730 days or at least one hospital separation with the diagnosis of epilepsy.

Results: Between 2005 and 2010 the overall crude and age-standardized incidences of epilepsy were 63 new epilepsy patients per 100,000 person-years and 62 per 100,000 person-years respectively. The overall age-specific incidence showed a gradual increase toward a high point in elderly. The incidence rate was slightly higher in men than in women who were older than 39 years. There was a significant downward trend over time in the incidence of epilepsy from 2005 to 2010 in Saskatchewan.

For self-declared RI the overall age-standardized incidence of epilepsy was 122 per 100,000 person-years. The rate ratio (RR) incidence difference between self-identified Registered Indian (RI) and non-self-identified RI was 1.6.

Conclusions: The incidence of epilepsy in Saskatchewan, Canada was comparable to previous incidence studies from developed countries. This study is the first Canadian study calculating the secular trends and all-age group incidence of epilepsy and one of the few studies showing the incidence of epilepsy in a self-declared Registered Indian population.

1. Introduction

New epidemiological studies for chronic neurological disease such as epilepsy are necessary as populations change through urbanization, migration, aging, new threats to human health, routine use of prevention measures, and rising inequalities in modern societies [1].

Moreover, to adequately monitor and evaluate any programs or interventions in epilepsy, it is vital to collect epidemiological data before initiation of the process [2]. In particular, it is crucial to provide information about the frequency of new cases of epilepsy and patterns of changes over time in the population targeted for intervention.

Previous studies around the world in developed countries report the overall incidence of epilepsy to be about 50 per 100,000/person years (range 40–70 per 100 000/person years) [3,4]. These numbers appear remarkably consistent for at least the last two decades, mainly in

developed countries. Also, fairly consistent is the finding that epilepsy has most commonly its onset at the extremes of life following a U-shape distribution with high incidence in the first few months of life, much lower incidence after the first year of life and then the highest incidence in elderly [5]. However, some studies have shown a significant decline in the incidence of epilepsy in children and adults over time with a concomitant increment in frequency among the elderly [6].

There are few studies exploring possible racial differences, specifically for Native Americans or Aboriginal population. These few available studies have been focussed on the elderly population and have determined that Native Americans have a statistically lower incidence of epilepsy (1.1 per 1000) [7] or even no cases compared with a white elderly population (2.3 per 1000) [8].

In spite of epilepsy being the most common neurological condition worldwide, in Canada, there are numerous gaps in the knowledge about

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its epidemiology [9]. For example, there are few studies that have examined the incidence of epilepsy in Canada, and those that have limited their analysis to specific age groups [10,11] and restricted syndromes [12]. Accordingly, there are no overall estimates of the incidence of epilepsy in Canada nor analyses of its secular trends.

The purpose of this study was to estimate the overall incidence epilepsy rate and its secular trends between 2005 and 2010 in the province of Saskatchewan, Canada. Estimates by sex, age, and self-declared Register Indian (RI) status were calculated and contrasted.

2. Methods

2.1. Setting

Saskatchewan is one of the western prairie provinces of Canada covering 651,900 square kilometers (6.5% of Canada's 9,984,670 square kilometers). Saskatchewan's populace (1,033,381 people in 2011) represents approximately 3% of the total population of Canada [13]. According to the 2011 census population of Saskatchewan, 50.5% of individuals were females, and 49.5% were males. The Saskatchewan age distribution is similar to the Canadian distribution by age group with children under the age of 15 accounting for 19%; the working age population (age 15 to 64 years) accounting for 66% (681,815 individuals); and seniors (aged 65 and over) accounting for 15% [13]. Saskatchewan residents largely described themselves as being of European ancestry (76%); self-declared Aboriginals (15.6%), and other (8.4%). The largest component of self-declared Aboriginal residents were members of First Nations in 66.6% followed by Metis people (33.3%) [14].

In Saskatchewan, all residents receiving medical coverage constituted the "covered population" for the present study. This population excluded federally insured residents (such as federal prison inmates, individuals from the Canadian Forces and Royal Canadian Mounted Police).

2.2. Data source

Data were extracted from three main administrative health databases from the province of Saskatchewan and were linked at the patient-level through of a unique personal Health Services Numbers. The three health services claim data were: Person Registry, Hospital Separation Data, and Physicians services data.

1. Person Registry: provides information on all residents eligible for Saskatchewan Health benefits and provides demographic information about the covered population. The self-declared Registered Indian status code was used in this study.
2. Hospital Separation Data included patient information on every discharge, transfer, or in-hospital death in Saskatchewan including diagnoses, procedures, and hospital admission/discharge dates. Records of inpatient separations and day surgeries for patients treated in hospitals were captured as well as out-of-province hospital separations for Saskatchewan health beneficiaries.
3. Physician's services data included doctor and nurse practitioner service claims for payment from the provincial government for services provided to patients. Patient information was included, as well as service information such as date, fee code, type, diagnosis code associated with service (maximum of one diagnosis code per service claim), location, and payment information [15]. Physicians who are remunerated on a non-fee-for-service basis are also expected to submit same 'shadow,' or "dummy" billing claims.

2.2.1. Self-declared Register Indian status

Registered Indians or Indians Status are the self-identified Aboriginal person registered with the federal government and Saskatchewan Health as Indians, which only include First Nation

people. RI are entitled to some benefits that are not available to Non-Status Indians or Metis people such as on-reserve housing benefits, education, and exemption from federal, provincial and territorial taxes in specific situations [16].

The Indian Act of 1867 defined "Indian" as [17]:

1. Any male person of Indian blood reputed to belong to particular band;
2. Any child of such person;
3. Any woman who is or was lawfully married to such person

Registered Indians (RI) were identified through a flag in the person registry dataset. Information regarding the date of registration (initiation or withdrawal) was not reported.

2.3. Epilepsy case definition algorithm

The cohort studied included individuals who had their first –ever recorded identification of epilepsy between January 1, 2001, and December 31, 2010, in either one of two administrative health databases (hospital separation data or Physician's services data). Eligible individuals had at least two years of continuous provincial health coverage from the start of the insurance (January 1, 1999) until December 31, 2010, or expiration of their insurance or their death.

The specific criteria used to define cases of epilepsy were as follows:

1. During the period January 1, 2001, to December 31, 2010, the subject had, at least, one hospital separation with a diagnosis of epilepsy (ICD-9 345 or ICD-10-Ca G40)
- or
2. During the period January 1, 1999, to December 31, 2010, the subject had at least two physician visits with a diagnosis of epilepsy (ICD-9 345 or ICD-10-Ca G40) on different dates within 730 days; the second of the two physician visits had to be on or after January 1, 2001. The medical services file was processed until the first pair of physician visit met these criteria. When this was met, the date of the first of the two physician visits was taken as the case date.

The use of ICD-10-CA codes was introduced by the Canadian Institute for Health Information to meet Canadian morbidity data needs and are used across Canada. Therefore, there are no differences in the use of ICD between provinces.

In Saskatchewan, ICD-10-CA codes were introduced on April 1, 2001, after which time approximately 30% of hospitals in Saskatchewan continued to use ICD-9 codes. By April 1, 2002, the transition to ICD-10-CA codes was complete, and all hospitals in the province were using this system. Accordingly, ICD-9 codes were used for the washout period; therefore, only ICD-10-CA codes were used for the analyzed period.

2.4. Statistical analysis

Incident cases were declared between January 1st, 2005 and Dec 31st, 2010 following a four-year washout period as per the standards for epidemiological studies and surveillance of epilepsy [18].

The incidence rate of epilepsy in Saskatchewan was calculated as the number of people who were declared as new cases over the six years period (2005–2010) for overall incidence. Annual new cases were calculated for annual incidence and analysis of trends. These number of new cases was divided by the mid-year covered population (person-years) over the six years period and annually. 95% confidence intervals (95%CI) were calculated for all crude and age-standardized rates.

The age-standardized estimates of incidence were obtained by directly adjusting our estimates to the 2006 Canadian population. Age-adjusted estimates of the incidence of epilepsy were compared by constructing the 95% CI for each estimate.

Changes in incidence between 2005 and 2010 were measured in absolute numbers and the rate ratio (RR) as a measure of association.

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