

# Stroke Surveillance in Saskatchewan 2014/2015

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**Purpose:**

The purpose of this report is to present key population health indicators related to stroke (cerebrovascular disease) including prevalence (number of existing cases), incidence (new cases per year), all-cause mortality (deceased cases per year), all-cause hospital length of stay, and acute stroke hospitalization in Saskatchewan.

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## BACKGROUND

This snapshot report highlights key population health indicators of stroke in Saskatchewan. Stroke is the third leading cause of death in Canada and the tenth largest contributor to disability-adjusted life years (the number of years lost due to ill health, disability or early death).

This report describes the age- and sex-specific prevalence (people living with the disease) of stroke at the provincial level in 2014/15, and provides estimates of changes in

incidence (new cases), mortality, and acute stroke hospitalization rates from 2000/01 to 2014/15. The report also provides 2014/15 age-standardized prevalence and incidence rate estimates for comparison of disease burden in each of the former regional health authorities (RHAs) with the former Keewatin Yatthé and Mamawetan Churchill River RHAs combined with Athabasca Health Authority and named northern regions.

## KEY FINDINGS

**In 2014/15 for residents 20 years of age and older:**

- more than 27,000 (3%) people had a stroke since 1995/96; and
- people who had a stroke were three to seven times more likely to have another of the following chronic diseases: diabetes mellitus (DM), hypertension (HYP), ischemic heart disease (IHD) and heart failure (HF) compared to all residents.

**From 2000/01-2004/05 to 2010/11-2014/15 for residents aged 20 years and older:**

- stroke incidence rates (new cases per year) decreased from about 3,500 (5 per 1,000) per year to about 2,700 (3 per 1,000) per year;
- all-cause mortality rates for people who had a stroke significantly decreased from about 39 per 1,000 in 2000/01-2004/05 to a stable 33 per 1,000 in the last 10 years 2005/06-2014/15;

- all-cause mortality rates for people with stroke were consistently about four times higher than rates for people without stroke; and
- the average number of days spent in hospital for any cause by people who had a stroke was substantially higher than the number of days spent in hospital by people without stroke, with five to nine times more hospital days in any year.

**From 1995/96 to 2014/15 for residents aged 20 years and older, annual prevalence of acute stroke hospitalization:**

- decreased significantly from 2.3% (1,700 cases per year) in 1995/96 to 1.3% (1,200 cases per year) in 2007/08, and remained stable at 1.3% (1,200 cases per year) from 2007/08 to 2014/15;
- was significantly higher for men than for women in each year; and
- about one-third of cases (31%) died within one year of hospitalization.

## STROKE CO-PREVALENCE

Individuals can have more than one chronic disease, and diseases that share similar risk factors often occur together in one person (co-prevalence). Not only does stroke share risk factors such as obesity and smoking with DM, HYP, IHD and HF, all of these diseases in and of themselves are risk factors for stroke. Table 1 shows 2014/15 co-prevalence of these diseases with stroke and that:

- the co-prevalence of stroke among people with the other chronic diseases listed above is about 10-22% and about three to seven times higher than the prevalence of stroke in the total population (3%);
- stroke co-prevalence is highest among people with HF (22%, ages 40 years and older), followed by IHD (16%), and DM or HYP (10%);
- the prevalence of the other chronic diseases among people with stroke (20-79%) is about three to seven times higher than the prevalence of these diseases in the total population of 20 years and older; and
- HYP (79%) has the highest co-prevalence among people with stroke, followed by IHD (42%), DM (31%), and HF (20%).

**Table 1: Number (%) of people with DM, HYP, IHD and HF who have had a stroke, and percentage of people with stroke who have DM, HYP, IHD and HF, 2014/15**

Disease (age)	Number with disease (% of total population)	Number with disease and stroke (% disease with stroke)	% of stroke cases with disease
DM (20+)	85,833 (10)	8,387 (10)	31
HYP (20+)	227,763 (26)	21,672 (10)	79
IHD (20+)	70,261 (8)	11,466 (16)	42
HF (40+)	24,987 (3)	5,445 (22)	20
Stroke (20+)	27,281 (3)	27,281 (100)	100
Total population 20+	889,621	n/a	n/a

n/a = not applicable

**Prevalence:**

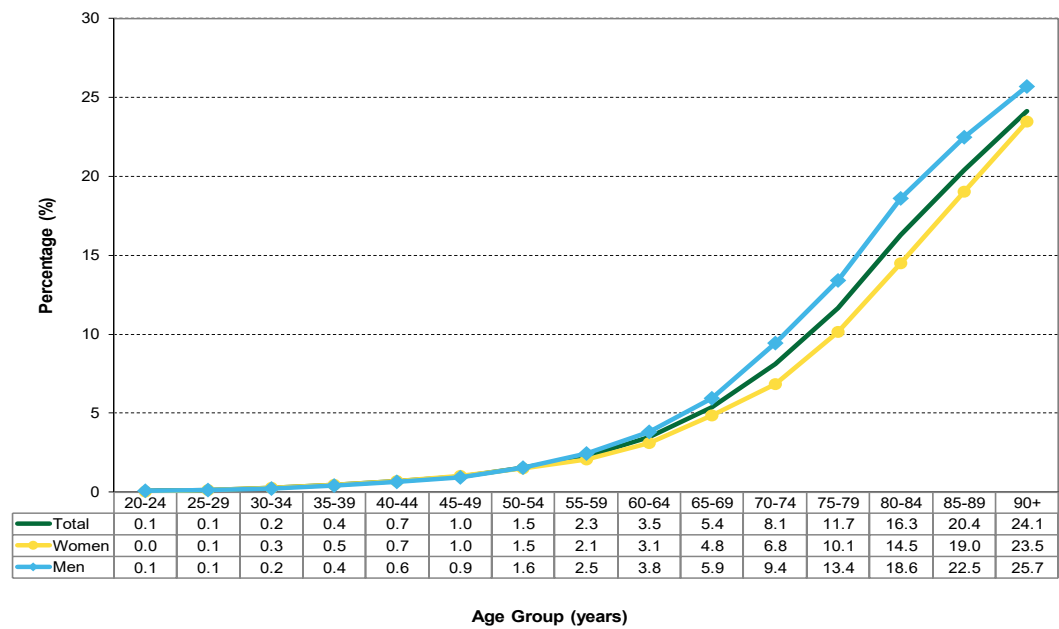
**A. Definition:**  
Prevalence is the total number of people known to be living with a disease at any time during a specific period.

**B. Significance/Use:**  
Prevalence provides an estimate of the burden of disease at a given time, and is widely used in public health monitoring and planning for services and programs, setting objectives and targets and comparing disease status over person, place and time.

**C. Limitations:**  
Prevalence is influenced by both the number of new cases and the duration of a disease. A high prevalence of a disease may reflect a high incidence where new cases rapidly occur, or prolonged duration, where those with the condition survive for a long time. Conversely, a low prevalence may indicate fewer new cases or a shorter survival of those with a chronic disease.

## STROKE PREVALENCE

**Figure 1: Age-specific stroke prevalence by sex, 2014/15**



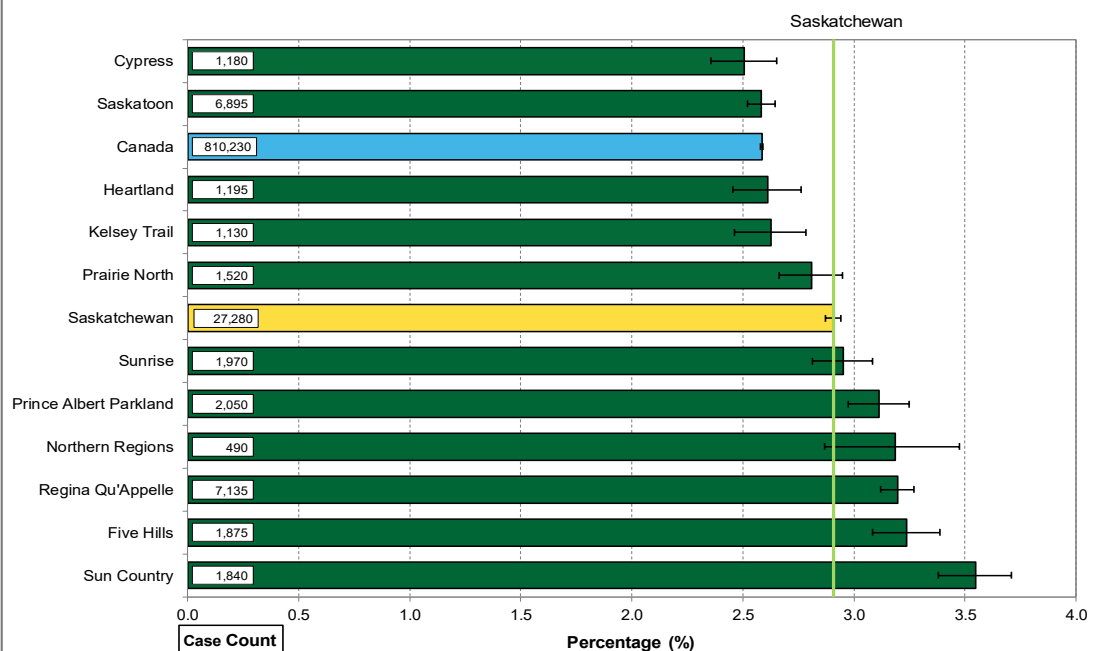
**In 2014/15 for residents 20 years of age and older:**

- more than 27,000 (3%) had a stroke since 1995/96;
- stroke prevalence increased with age to almost one-quarter (25%) in the older than 90 years age group; and
- the percentages of men and women with stroke were similar at ages 20 to 54 years, but higher for men than women at ages 55 years and older.

**In 2014/15 compared to the province, stroke prevalence was:**

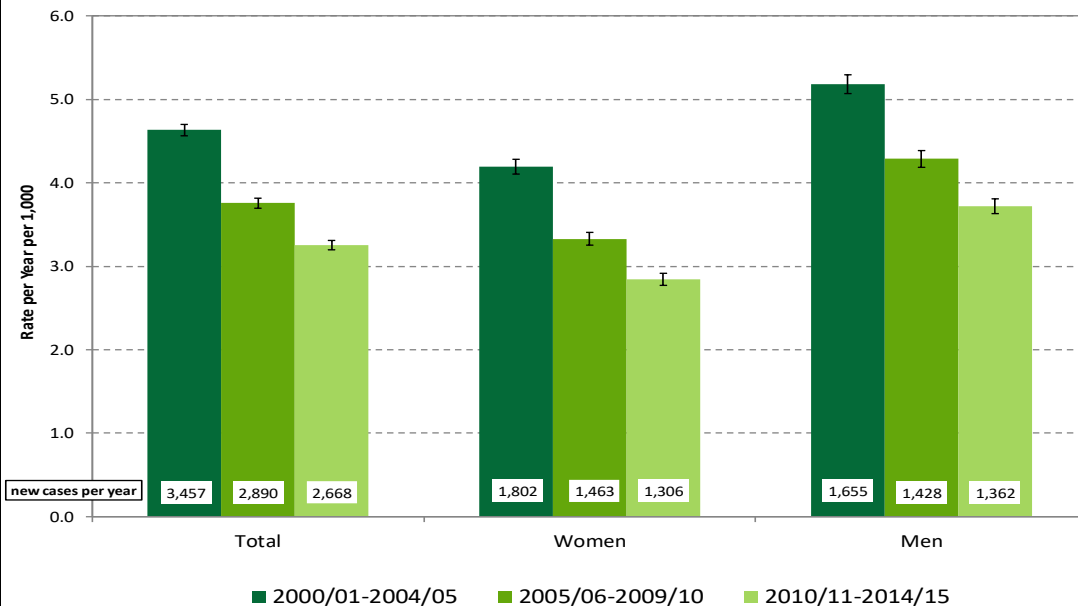
- significantly lower in Canada and the former Cypress, Saskatoon, Heartland, and Kelsey Trail health regions; and
- significantly higher in the former Regina Qu'Appelle, Five Hills, and Sun Country health regions.

**Figure 2: Age-standardized stroke prevalence and case counts by former health region, 2014/15**



# STROKE INCIDENCE

**Figure 3: Average age-standardized stroke incidence rates and new cases per year by sex, 2000/01-2004/05 to 2010/11-2014/15**



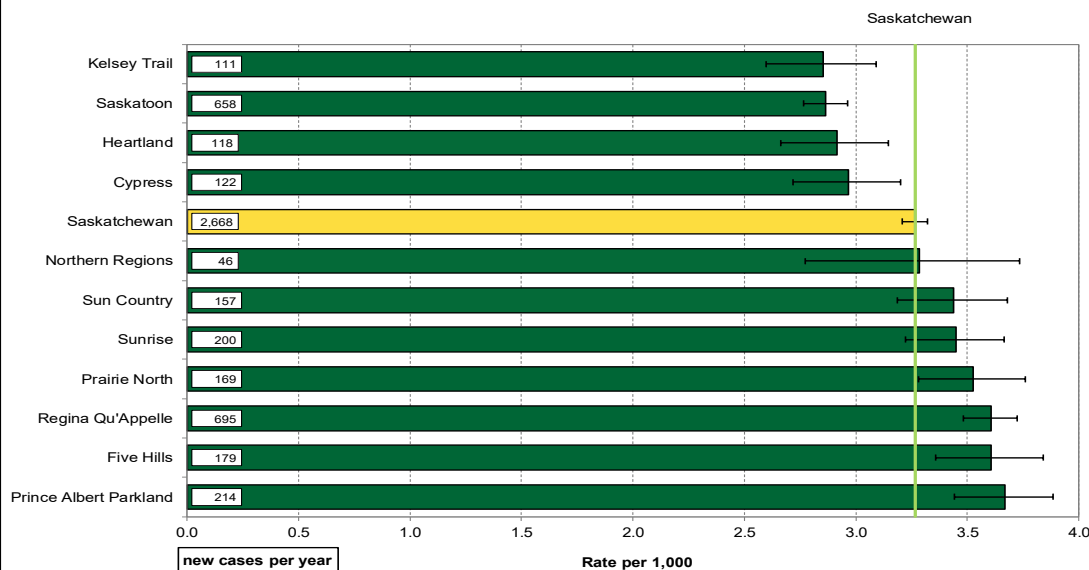
From 2000/01-2004/05 to 2010/11-2014/15 for residents aged 20 years and older, stroke incidence rates (new cases per year):

- decreased from about 3,500 (about 5 per 1,000) per year to about 2,700 (about 3 per 1,000) per year;
- decreased by about 32% for women and about 28% for men; and
- were significantly higher for men than for women in all three five-year periods.

In 2010/11-2014/15 compared to the provincial rate, stroke incidence rates were:

- significantly lower in the former Kelsey Trail, Saskatoon, and Heartland health regions; and
- significantly higher in the former Regina Qu'Appelle, Five Hills, and Prince Albert Parkland health regions.

**Figure 4: Average age-standardized stroke incidence rates and new cases counts by former health region, 2010/11-2014/15**



**Incidence:**

**A. Definition:**

Incidence refers to the number of new cases detected in the population at risk for the disease during a specific period.

**B. Significance/Use :**

Incidence rates provide information about the risk of developing a disease.

**C. Limitations:**

Stroke incidence rates are influenced by many health determinants, including non-modifiable risk factors like age and modifiable risk factors such as, smoking and obesity, or exposure to primary, secondary, and tertiary prevention.

Changing diagnostic criteria and physician billing practices may cause significant short-term fluctuations in incidence estimates.

**All-cause Mortality:**

A. Definition:  
Mortality refers to the proportion of a population that dies during a specified time period. This measure refers to deaths of people aged 20 years and older with stroke regardless of the cause. Dates and fact of death are based on the demographic data of the person health registration system (PHRS).

B. Significance/Use:  
Risk of death is considerably elevated in people with stroke compared to people without stroke. Assessment of elevated death risk is accomplished by dividing the age-standardized rate of people with stroke by the age-standardized rate of people without stroke. If the result is around one it indicates little to no elevated risk, whereas for example a result of 1.5 indicates an increased death risk of 50%.

C. Note:  
Mortality is based on all causes of death and not just deaths caused by stroke.

**All-cause Hospital Days:**

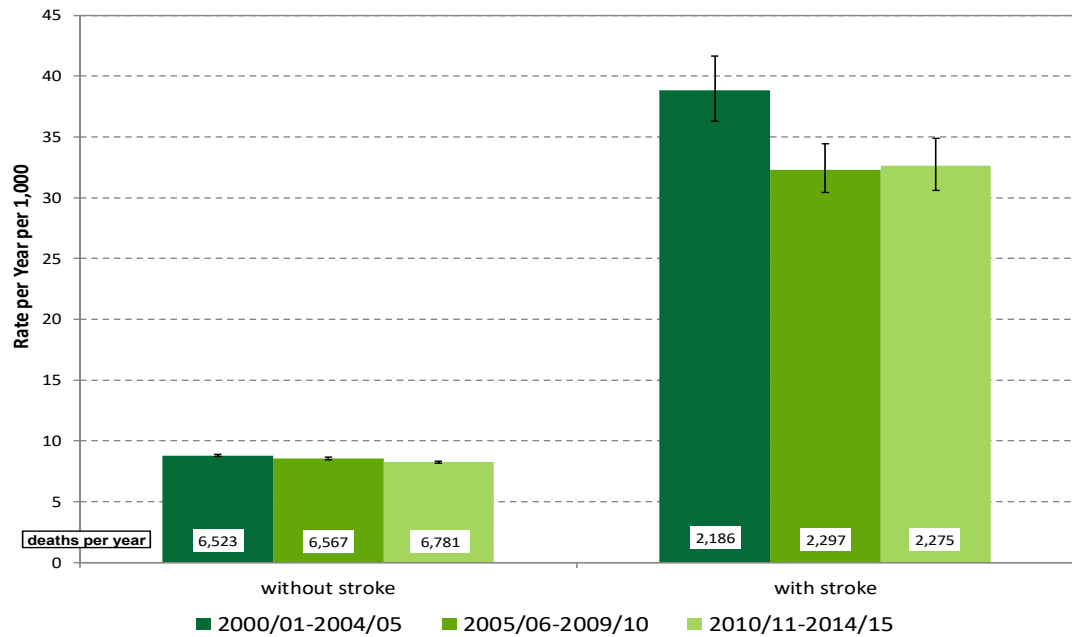
A. Definition:  
Inpatient days of hospitalization are calculated using the difference between the date of discharge and the date of admission. Same-day stays are excluded.

B. Significance/Use:  
Health care use indicators such as hospital length of stay are considerably elevated in people with stroke compared to people without stroke. Assessment of elevated hospital utilization is accomplished by dividing the age-standardized hospital days rate of people with disease by the age-standardized rate of people without disease. Reducing a measurable gap in hospital utilization between people with stroke vs. those without stroke is a common objective for chronic disease management at the population level.

C. Note:  
Hospital length of stay is based on all reasons for hospitalization and not just hospitalization due to stroke.

**STROKE ALL-CAUSE MORTALITY AND HOSPITAL DAYS**

**Figure 5: Average age-standardized all-cause mortality rates and number of deaths per year by stroke status, 2000/01-2004/05 to 2010/11-2014/15**



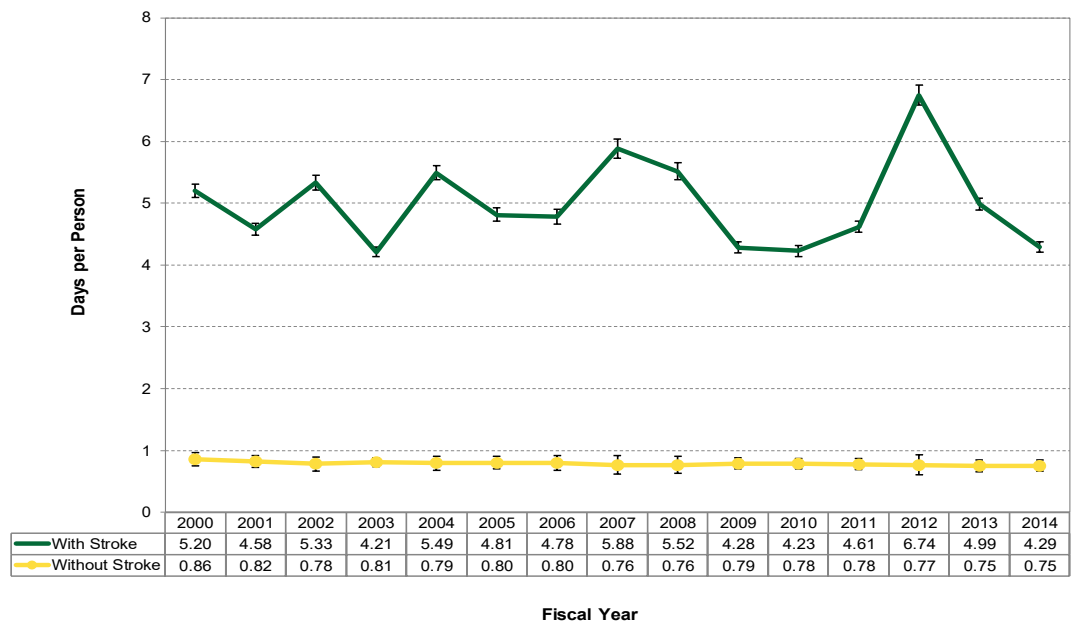
From 2000/01-2004/05 to 2010/11-2014/15 for residents aged 20 years and older, all-cause mortality rates for people who had a stroke:

- significantly decreased from about 39 per 1,000 in 2000/01-2004/05 to a stable 33 per 1,000 in the last 10 years 2005/06-2014/15, and
- were about four times higher than all-cause mortality rates of people without stroke.

From 2000/01 to 2014/15 for residents aged 20 years and older, the average number of days spent in hospital for any cause by people who had a stroke:

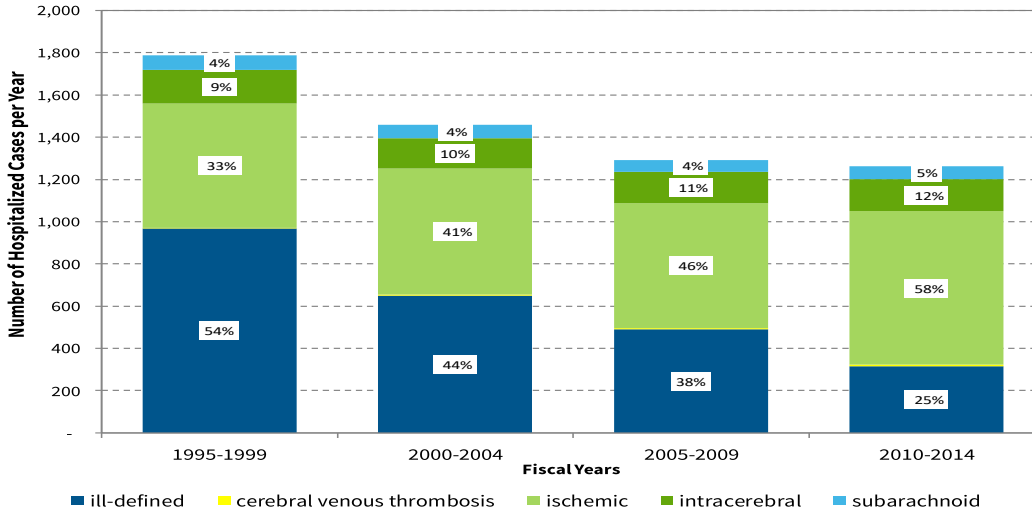
- was variable from year to year ranging from 4.2 days to 6.6 days per person, and
- were substantially higher than the number of days spent in hospital by people without stroke, with five to nine times more hospital days per year.

**Figure 6: Age-standardized days spent in hospital for any cause by stroke status, 2000/01 to 2014/15**



# ACUTE HOSPITALIZED STROKE

**Figure 7: Counts and percentages of acute hospitalized stroke by type of stroke and year, 1995/96-1999/2000 to 2010/11-2014/15**



**From 1995/96-1999/2000 to 2010/11-2014/15 for residents aged 20 years and older:**

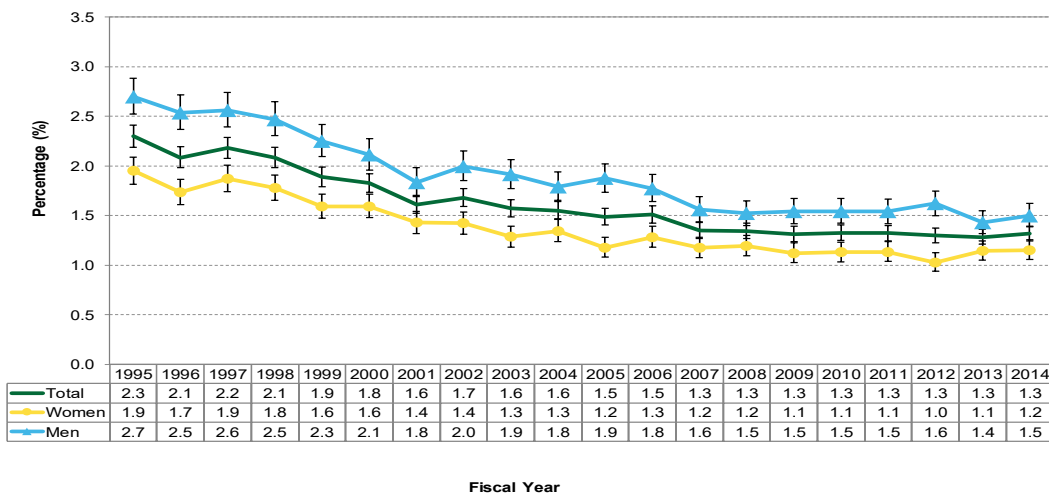
- the average annual number of people hospitalized for acute stroke declined from about 1,700 per year in 1995/96-1999/2000 through 1,400 per year in 2000/01-2004/05 to a stable 1,200 per year in the last 10 years 2005/06-2014/15;
- the proportion of ill-defined acute stroke cases has declined steadily from 54% in 1995/96-1999/2000 to 25% in 2010/11-2014/15 with corresponding increasing proportions of well-defined acute stroke types;
- in 2010/11-2014/15, more than half of acute strokes were ischemic (58%), followed by ill-defined (25%), intracerebral (12%), subarachnoid (5%), and cerebral venous thrombosis (0.6%); and

- overall acute stroke annual prevalence is lower than the sums of acute stroke types shown in Figure 7 because about 5% of people with acute stroke were hospitalized for more than one acute stroke type in a year.

**From 1995/96 to 2014/15 for residents aged 20 years and older, annual prevalence of acute stroke hospitalization:**

- decreased significantly from 2.3% in 1995/96 to 1.3% in 2007/08, and remained stable at 1.3% from 2007/08 to 2014/15;
- was significantly higher for men than for women in each year; and
- about one-third of cases (31%) died within one year of hospitalization (not shown in figures).

**Figure 8: Age-standardized acute hospitalized stroke annual prevalence by sex, 1995/96 to 2014/15**



**Acute Stroke Hospitalization:**

A. Definition: Acute stroke hospitalization captures the occurrence of hospital interactions where stroke was listed as the most responsible diagnosis (i.e., resource-intensive reason) for the hospital stay. This includes the following types of stroke:

- Acute but ill-defined stroke, not specified as haemorrhage or infarction** means that the type of stroke was not determined.
- Cerebral venous thrombosis** is the presence of a blood clot in the venous channels that drain blood from the brain.
- Ischemic stroke** occurs when arteries to the brain become narrowed or blocked, causing severely reduced blood flow.
- Intracerebral haemorrhage** occurs when a diseased blood vessel within the brain bursts, allowing blood to leak inside the brain.
- Subarachnoid haemorrhage** is bleeding in the space between the brain and its surrounding membrane.

B. Significance/Use: Acute stroke hospitalization tells us about the burden of serious stroke events and allows estimation of the burden on the health care system due to effects of serious stroke.

## TECHNICAL NOTES

### Method:

Chronic disease estimates are based on the infrastructure and case definitions of the Canadian Chronic Disease Surveillance System (CCDSS), with support of the Public Health Agency of Canada. This method is based on linkage of administrative data sources including:

- person health registration system which includes all residents eligible for Saskatchewan health benefits;
- hospital services which include data on hospital inpatient separations for beneficiaries; and
- medical services which include physician and nurse practitioner service claims for beneficiaries.

Diagnoses are coded in hospital according to the International Classification of Diseases system levels ICD-9 or ICD-10-CA. All but five Saskatchewan hospitals started coding with ICD-10-CA in 2001/02, which accounted for 70% of hospital separation records that year. All Saskatchewan hospitals were coding with ICD-10-CA in 2002/03.

Diagnoses in medical services are coded according to ICD-9 system in all years. Ascertainment of chronic disease cases in the CCDSS starts with the 1995/96 fiscal year.

### Case Definitions:

For surveillance purposes, the stroke case definition requires that an individual has EITHER:

- one or more inpatient hospital separations with a diagnosis of ICD-9 codes 325, 362.3x, 430, 431, 432.9, 433.x1, 434 (or 434.x1), 435.x, 436, 437.6 or ICD-10-CA codes G08, G45.x (exclude G45.4), H34.0, H34.1, I60.x, I61.x, I62.9, I63.x, I64, I67.6 in any field of the hospital separation record; OR
- two or more medical claims with a diagnosis of ICD-9 code 325, 430, 431, 434, 435, 436 within one year.

The stroke case definition applies to ages 20 years and older.

For the subset of acute stroke (see page 7), the case definitions use the following ICD codes:

- **Acute but ill-defined stroke, not specified as haemorrhage or infarction**  
ICD-9 code 436 or ICD-10-CA code I64.
- **Cerebral venous thrombosis**  
ICD-9 codes 325, 437.6 or ICD-10-CA codes I63.6, I67.6, G08.
- **Ischemic stroke**  
ICD-9 codes 362.3x, 433.x1 (ICD-9-CM), 434.x1 (ICD-9-CM) or 434 or ICD-10-CA codes H34.1 and I63.x (exclude I63.6).
- **Intracerebral haemorrhage**  
ICD-9 codes 431 and 432.9 or ICD-10-CA codes I61.x and I62.9.
- **Subarachnoid haemorrhage**  
ICD-9 code 430 or ICD-10-CA codes I60.x.

Case definitions for DM and HYP are described in the [Prevalence of Asthma, COPD, Diabetes, and Hypertension in Saskatchewan](#) report and for IHD and HF in the [Prevalence and Incidence of Ischemic Heart Disease and Heart Failure in Saskatchewan](#) report.

### Calculations:

Age standardization allows comparisons to be made among groups of people with different age distributions, or comparisons over time. To adjust for differences in population age distributions and the resulting effect on rates, the hospital day rates were age-adjusted using the 2011 Canadian population as a reference. Adjustment was done via the direct method, using five-year age groups to age 85 years and older.

To facilitate comparisons, 95% confidence intervals (CIs) of all age-standardized rates were calculated for rates greater than zero. The CI includes the true value for the estimated rate 19 times out of 20. A rate difference was considered statistically significant if there was no overlap of confidence intervals.

### Limitations:

Stroke events that resulted in the death of the individual prior to admission to hospital are not captured.

Stroke cases that enter the emergency department but do not get admitted to hospital are not captured.

The case definition does not differentiate whether the individual is identified with an acute stroke or a transient ischemic attack (TIA).

The administrative data used do not capture people with unreported chronic disease, or who do not access the healthcare system.

A reported ICD code is assumed to be diagnostic and not a differential diagnosis.

The case definitions do not include services provided in emergency departments or hospital-based outpatient clinics.

Individuals with physician-diagnosed chronic conditions may not be captured if they receive their care in a setting where services are not billed on a fee-for-service basis. Services delivered by physicians in salaried or contractual arrangements are not captured if the service information is not submitted through "shadow billing".

Any system, which tracks lifelong diseases over many years on an individual basis, will tend to accumulate false positives. This is because a case, once identified, is carried forward from year to year. Even if false positives are extremely rare, they will inevitably comprise an increasing proportion of reported cases over time.

Provincial administrative data exclude full-time members of the Canadian Forces and inmates of federal correctional facilities, and prior to April 1, 2013 Royal Canadian Mounted Police, whose health benefits are covered by the federal government.