

Measuring Trends in Health Inequalities in Cities

Hospitalization and Day Surgery Indicators

Technical Notes





Canadian Institute for Health Information

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Canadian Institute for Health Information

The Canadian Institute for Health Information (CIHI) is an independent, not-for-profit organization dedicated to providing essential health information to all Canadians.

CIHI works closely with federal, provincial and territorial partners and stakeholders throughout Canada to gather, package and disseminate information to inform policy, management, care and research, leading to better and more equitable health outcomes for all Canadians.

Health information has become one of society's most valuable public goods. For 25 years, CIHI has set the pace on data privacy, security, accessibility and innovation to improve Canada's health systems.

CIHI: Better data. Better decisions. Healthier Canadians.

Urban Public Health Network

The Urban Public Health Network (UPHN) is a network of medical health officers working to address public health issues that are common to urban populations in Canada. Its members are responsible for overseeing public health in the largest urban centres in each province and are together responsible for improving the population health of more than half of Canadians. The network regularly augments its work by collaborating with common-cause governmental and non-governmental organizations.

Project background

The UPHN is working with Statistics Canada and CIHI to measure health inequalities in many of Canada's major cities. As a collaborator on this project, CIHI has calculated rates and measured health inequalities using indicators on the following topics, which were prioritized by the UPHN membership for inclusion in the project:

- Hospitalizations for
 - Ambulatory care sensitive conditions
 - Opioid poisonings
 - Conditions entirely caused by alcohol
 - Heart attacks

- Stroke
- Injury (including falls injury)
- Motor vehicle traffic injury
- Self-injury
- Day surgery for childhood dental caries

For the analysis, 5 years of data were pooled and indicator results were calculated at the census metropolitan area (<u>CMA</u>; e.g., Greater Toronto Area) and census subdivision (<u>CSD</u>; e.g., City of Mississauga) levels for participating members of the UPHN, where data was available.

Hospitalization and day surgery indicators

<u>CIHI's Indicator Library</u> provides detailed information for indicators that CIHI regularly reports on, including

- Inclusion and exclusion criteria;
- Unit of measurement;
- Description;
- Detailed notes on indicator-specific methodology and calculations;
- Interpretation; and
- Data sources.

Table 1 provides information about each of the indicators included in this project.

- For indicators that CIHI regularly reports on click the link in the table to go to the Indicator Library, then go to the Detailed View tab (see <u>Appendix: Navigating CIHI's</u> <u>Indicator Library</u>).
- For indicators that CIHI does not regularly report on detailed information is provided in the table.

Table 1Details for hospitalization and day surgery indicators

Indicator name	Indicator information			
Ambulatory Care	CIHI's Indicatory Library — Ambulatory Care Sensitive Conditions			
Sensitive conditions	Broken down for chronic obstructive pulmonary disease (COPD), diabetes, asthma,			
	heart failure and pulmonary edema, hypertension, angina, and grand mal status and			
	other epileptic convulsions			
	Available data years (fiscal)			
	Pooled 2006–2007 to 2010–2011; 2011–2012 to 2015–2016			
Hospitalizations Due	Description			
to Opioid Poisoning	Rate of hospitalizations due to intentional or unintentional opioid poisonings for all			
	ages (per 100,000 population)			
	Numerator			
	Inclusions:			
	1. ICD-10-CA codes for only those involving relevant opioid poisonings:			
	• T40.0 (poisoning by opium)			
	• T40.1 (poisoning by heroin)			
	• T40.2 (poisoning by other opioids)			
	• T40.3 (poisoning by methadone)			
	• T40.4 (poisoning by synthetic opioids)			
	• T40.6 (poisoning by unspecified/other opioids)			
	Exclusion:			
	1. Codes with a prefix of Q indicating a suspected diagnosis, to limit analysis to confirmed cases			
	Interpretation			
	Lower rates are desirable.			
	Data source			
	Hospital Morbidity Database (HMDB)			
	Available data years (fiscal)			
	Pooled 2007–2008 to 2010–2011; 2011–2012 to 2015–2016			
Hospitalizations	CIHI's Indicatory Library — Hospitalizations Entirely Caused by Alcohol			
Entirely Caused	Available data vears (fiscal)			
by Alcohol	Pooled 2014–2015 to 2015–2016			
Hospitalized	CIHI's Indicator Library — Hospitalized Heart Attacks			
Heart Attacks	Available data years (fiscal)			
	Pooled 2011–2012, 2013–2014 to 2015–2016; rates were not available for 2012–2013.			

Indicator name	Indicator information					
Hospitalized Strokes	CIHI's Indicator Library — Hospitalized Strokes					
	Available data years (fiscal)					
	Pooled 2011–2012 to 2015–2016					
	Note: Results for Quebec were not available.					
Injury Hospitalization	CIHI's Indicator Library — Injury Hospitalization					
	Broken down for falls					
	Available data years (fiscal)					
	Pooled 2007–2008 to 2010–2011; 2011–2012 to 2015–2016					
Motor Vehicle Traffic	Description					
Injury Hospitalization	Age-standardized rate of hospitalization due to injury resulting from motor vehicle traffic accidents (per 100,000 population)					
	Numerator					
	Total number of separations from acute care hospitals (including discharges, deaths,					
	sign-outs and transfers) resulting from motor vehicle traffic accident injuries					
	Inclusions:					
	1. ICD-10-CA codes:					
	V19.6, V20.§–V28.§, V29.♥, V02.▲–V04.▲, V09.2, V12.§–V14.§, V30.*–V38.*, V39.†, V40.*–V48.*, V49.†, V50.*–V58.*, V59.†, V60.*–V68.*, V69.†, V70.*–V78.*, V79.†, V83.‡–V86.‡, V86.08, V86.38, V87.0–V87.8, V89.2					
	Legend:					
	§ — 4, 5, 9					
	▼ — 5, 6, 8, 9					
	▲ — 1, 9					
	* — 5, 6, 7, 9					
	† — 4, 5, 6, 8, 9					
	= - 0, 1, 2, 3					
	Exclusions:					
	1. Newborn, stillbirth or cadaveric donor records					
	2. Records where the sex is not recorded as male or female					
	Data sources					
	Discharge Abstract Database (DAD) and Hospital Morbidity Database (HMDB)					
	Available data years (fiscal)					
	Pooled 2007–2008 to 2010–2011; 2011–2012 to 2015–2016					

Indicator name	Indicator information				
Self-Injury	CIHI's Indicator Library — Self-Injury Hospitalization				
Hospitalization	Available data years (fiscal)				
	Pooled 2009–2010 to 2010–2011; 2011–2012 to 2015–2016				
Day Surgery	Description				
for Childhood Dental Caries	Rate of day surgery procedures for early childhood caries for children between age 1 and younger than 5 (per 100,000 population)				
	Numerator				
	Inclusions:				
	 Day surgery records from the Discharge Abstract Database and the National Ambulatory Care Reporting System 				
	2. Cohort restricted to between age 1 and younger than 5				
	 Discharge records containing both a diagnosis of dental caries (ICD-10-CA codes K02 and K04.7) and an identified surgical dental procedure (filling, extraction and/or other CCI codes: 1.FE.57.JA, 1.FF.56, 1.FF.89, 1.FE.89, 1.FE.29, 1.FE.53.JA–RV, 1.FF.59.JA, 1.FD.52, 1.FE.87.JA–H1, 1.FF.53, 1.FF.80 and 1.FF.87) 				
	Exclusions:				
	1. Potential duplicate discharge records				
	 Records containing an identified diagnosis of dental trauma anywhere in the abstract 				
	3. Records containing an identified diagnosis of a developmental handicap anywhere in the abstract				
	Interpretation				
	Lower rates are desirable.				
	Data sources				
	Discharge Abstract Database (DAD) and National Ambulatory Care Reporting System (NACRS)				
	Available data years (fiscal)				
	2010–2011; pooled 2011–2012 to 2015–2016				
	Note: Quebec elected to not participate.				

Note

Quebec results are available for 2011–2012 to 2015–2016 only. As a result, CMA rates for Ottawa–Gatineau are not available prior to 2011–2012, but CSD rates for Ottawa, Russell and Clarence–Rockland are available.

Data sources

The **Discharge Abstract Database** (DAD) is a national-level database that captures administrative and clinical information from inpatient separation records (discharges, deaths, sign-outs and transfers) from acute care hospitals from all provinces and territories in Canada, with the exception of Quebec. Some provinces and territories also use the DAD to capture day surgery information.

The **Hospital Morbidity Database** (HMDB) complements the DAD and captures administrative, clinical and demographic information on inpatient separation records from acute care hospitals across Canada, including Quebec. Source files for the HMDB include both the DAD and those from the ministère de la Santé et des Services sociaux du Québec.

Ambulatory care data is provided by the **National Ambulatory Care Reporting System** (NACRS), which contains demographic, administrative, clinical and service-specific data for emergency department, day surgery and other ambulatory care visits for 427 facilities across Canada, excluding Newfoundland and Labrador, New Brunswick, Quebec, the Northwest Territories and Nunavut.

Mental health data is captured through the **Hospital Mental Health Database** (HMHDB) and the **Ontario Mental Health Reporting System** (OMHRS). The HMHDB contains data from across Canada on hospitalizations for mental illness and addiction. It provides demographic, administrative and clinical information from all provinces and territories for inpatient hospital stays for psychiatric conditions. OMHRS captures administrative and clinical information on individuals admitted to designated adult mental health beds in Ontario.

For detailed information about data availability and coverage regarding CIHI's data holdings, visit CIHI's <u>Data Holdings</u> page.

Methodology

Geography definitions¹

Dissemination block (DB) is an area bounded on all sides by roads and/or boundaries of standard geographic areas. The DB is the smallest geographic area for which population and dwelling counts are disseminated in census data by Statistics Canada.

Dissemination area (DA) is a small, relatively stable geographic unit composed of 1 or more adjacent DBs. It is the smallest standard geographic area for which all census data is disseminated. Income quintiles are assigned at the DA level.

Census subdivision (CSD) defines the general term for municipalities (as determined by provincial/territorial legislation, such as cities and towns) or areas treated as municipal equivalents for statistical purposes (e.g., First Nations reserves, First Nations settlements and unorganized territories).

Census agglomeration (CA) is an area consisting of 1 or more neighbouring municipalities (CSDs) situated around a core. A CA must have a core population of at least 10,000. Areas that do not qualify for the definition of CMA (see below) are often classified as a CA. For example, Fredericton was classified as a CA prior to 2016 but is now a CMA due to population growth.

Census metropolitan area (CMA) is an area consisting of 1 or more neighbouring municipalities (CSDs) situated around a core. A CMA must have a total population of at least 100,000 of which 50,000 or more live in the core.

Determining CMAs for inclusion

The following 19 CMAs (CMAs as of the 2016 Statistics Canada Census and members of the UPHN) were included in this project:

- Victoria, Vancouver
- Calgary, Edmonton
- Saskatoon, Regina
- Winnipeg
- London, Hamilton, Toronto, Ottawa–Gatineau
- Montréal, Québec, Sherbrooke
- Halifax
- Moncton, Saint John, Fredericton
- St. John's

Statistical area classification codes group together CSDs based on whether they are part of a CMA, CA, or CMA- or CA-influenced zone or territory. CSDs outside a CMA are identified as 1 of 4 zones according to the degree of influence the CMA has upon it. The degree of influence is determined by the percentage of those residents working in the urban core of a CMA. DAs found within the following geographic boundaries and zones were excluded from the analyses:

- 000 = Territories;
- 996 = Strongly influenced zone (over 30% work in a CMA);
- 997 = Moderately influenced zone (5% to 30% work in a CMA);
- 998 = Weakly influenced zone (0% to 5% work in a CMA); and
- 999 = No influence zone (none of the residents work in a CMA).

In addition, those with missing statistical area classification codes were excluded.

Statistical Area Classification type (SACtype) identifies the type of statistical area classification in which the CSD is located. CSDs with the following population centre/rural area type were included in the analysis:

- CSD within CMA (type 1); and
- CSD within CA with at least 1 census tract (type 2).

Determining CSDs for inclusion/exclusion

To determine which CSDs to include for the CSD reporting, a population-based cut-off was developed to ensure that results were reliable. The reliability of the result is determined by using the coefficient of variation (CV), calculated as the ratio of the standard deviation and the rate, as recommended by Statistics Canada. Statistics Canada's guidelines recommended that a maximum CV of 33.3% is allowable and that any higher would indicate instability of the results.²

A negative binomial regression model was built to predict the denominator (population) required in order to have a stable CV result. The rates and standard deviation for a randomly sampled cluster of CSDs for the COPD indicator were used to build the model. The COPD indicator was chosen because it had one of the highest rates and would result in the lowest population threshold (i.e., most inclusive). It was determined that to obtain a CV less than or equal to 33.3% based on population size over 5 pooled years (2011–2012 to 2015–2016), the population must be greater than 7,678 for this indicator. This was then applied across all the indicators; CSDs with a 5-year pooled population less than 7,678 were excluded from the CSD analysis. This cut-off was applied to population count data for the CSDs, obtained from Statistics Canada for 2011 and 2016. As inter-census year population size for inter-census years.

Pooled numerator

Indicators were calculated at the record level and reported by patients' place of residence. Records were pooled over a 5-year period, starting with the census year (i.e., 2006–2007 to 2010–2011; 2011–2012 to 2015–2016). Records that could not be assigned valid provincial and regional information in Statistics Canada's Postal Code^{OM} Conversion File Plus (PCCF+) based on patient postal code were excluded from the analysis, representing less than 0.75% of the cases.

Pooled denominator

Total populations (denominator counts) for the CMAs and CSDs are based on Statistics Canada census estimates for the years 2006 to 2015 and pooled in 5-year intervals (i.e., 2006 to 2010, 2011 to 2015). For indicators where results were available for only some years, only the corresponding denominator counts for those years were used.

Defining geographic assignment and neighbourhood income quintile

This analysis was scoped to measure health inequalities using neighbourhood income quintiles. However, it is recognized that other socio-demographic factors (such as age, sex, geography and education) and indices may also provide important information about health inequalities in Canada. More information about other socio-demographic factors and the use of relative income quintiles can be found in CIHI's report *In Pursuit of Health Equity: Defining Stratifiers for Measuring Health Inequality*.

Statistics Canada's PCCF+ Version 6D was used to assign standard Canadian census geographic areas (such as DA, CSD and CMA) and neighbourhood income quintile information to patient records. Income quintiles are derived using before-tax income. The patient's residential postal code at the time of hospitalization/day surgery discharge was mapped to the corresponding DA using the closest census year to the discharge date. The income quintile, CSD and CMA associated with that DA were assigned to the patient's record.

Neighbourhood income quintiles available from the PCCF+ were based on the average income per single-person equivalent in a DA obtained from the 2006 (for 2006 to 2010 results) and 2016 (for 2011 to 2015 results) censuses. The 2011 Census does not contain income information. This measure uses the person weights implicit in the Statistics Canada low-income cut-offs to derive "single-person equivalent" multipliers for each household size. For example, a single-person household received a multiplier of 1.0, a 2-person household received a multiplier of 1.53. To calculate average income per single-person equivalent for each DA, total income of the DA was divided by the total number of single-person equivalents. Income quintile for DAs with a household population of less than 250 was imputed based on the neighbouring DAs (where possible), because census data on income for these DAs was suppressed. For more information, please refer to Statistics Canada's <u>Postal Code Conversion File (PCCF)</u> Reference Guide.

Quintiles of population by neighbourhood income were constructed separately for each CMA, CA or residual area within each province. DAs within each such area were ranked from the lowest average income per single-person equivalent to the highest, and DAs were assigned to 5 groups, such that each group contained approximately one-fifth of the total non-institutional population of each area.

Statistics Canada then pooled the quintile data across the areas. Quintiles were constructed within each area before aggregating to the national or provincial level to minimize the potential effect of the differences in income, housing and other living costs across different areas in the country. Quintile 1 refers to the lowest-income neighbourhoods, while quintile 5 refers to the highest-income neighbourhoods.

For more information on using an area-level approach and Statistics Canada's PCCF+, refer to <u>Area-Level Equity Stratifiers Using PCCF and PCCF+</u>.

Calculating numerator and denominator cases

For a given CSD, the numerator cases were disaggregated by income quintile and age group.

The denominator counts for the age groups of the DAs were taken from Statistics Canada for the census years 2006 and 2011, and a linear approximation escalator approach was used to estimate the population of the DA by age for inter-census years. For 2 indicators with special age groupings (Hospitalized Heart Attacks and Hospitalized Strokes), the denominator estimation was based on the census years 2011 and 2016 due to the availability of data. The denominators were aggregated by income quintile and age group across the CSD.



Age-standardized rates

Crude indicator rates were age-standardized by the direct method of standardization, using 2011 Census population data. CSD-specific rates were age-standardized to the CMA standard population that the CSD belonged to. CMA-based rates were standardized to the Canadian population to enable comparison across the nation. Standardization was based on 5-year age groups.

Age groups (in years)			
0–4	50–54		
5–9	55–59		
10–14	60–64		
15–19	65–69		
20–24	70–74		
25–29	75–79		
30–34	80–84		
35–39	85–89		
40–44	90+		
45–49	_		

Table 2 Age groups for age standardization

Note: Age standardization for the hospitalized heart attack and stroke indicators used slightly different age groups as they include people age 18 and older. For these 2 indicators, age groups started with an 18–24 age group followed by the 5-year age groupings listed above from 25–29 onward.

Age-standardized rate = $\frac{\text{Numerator}}{\text{Denominator}} \times \text{Standard population}$

The variance was calculated using the following formula:

Variance (Rate) = Weight² × Rate_{crude} × $\frac{(100,000 - (Rate_{crude}))}{Population}$

where weight was the weight of the standard population.

The 95% confidence interval was calculated by

Rate $1.96\sqrt{Variance(Rate)}$.

Calculating indicator rates by neighbourhood income quintile

The income analysis was carried out using neighbourhood income quintiles. This approach builds on previous analyses of income-related health inequalities reported on by CIHI (*Trends in Income-Related Health Inequalities in Canada*) and other health organizations across Canada. Less than 2.5% of records had missing income information for the indicators.

Quantifying inequalities using summary measures

Income-related inequalities were measured on both the relative (i.e., rate ratio) and absolute (i.e., rate difference) scales.

Rate ratio (RR) was calculated by dividing the rate of the lowest income quintile by the rate of the highest income quintile. This measures *relative* inequality.

Example: Measuring income-related inequalities, where Q1 is the lowest income quintile and Q5 is the highest income quintile

Q1 ÷ Q5 = 10 ÷ 5 = 2.00

Interpretation: The rate of condition X is 2 times higher for Canadians in the lowest income quintile than for Canadians in the highest income quintile.

The variance was calculated using the following formula:

 $Variance\left(Log\left(\frac{Rate_{Q1}}{Rate_{Q5}}\right)\right) = \frac{Variance (Rate_{Q1})}{Rate_{Q1}^{2}} + \frac{Variance (Rate_{Q5})}{Rate_{Q5}^{2}}$

The RR 95% confidence interval is given by

```
e(\log (\text{Rate ratio}) \pm 1.96 \sqrt{\text{Variance (Rate ratio)}})
```

Rate difference (RD) was calculated by subtracting the rate of the highest income quintile from the rate of the lowest income quintile. This measures *absolute* inequality.

Example: Q1 – Q5 = 10 – 5 = 5

Interpretation: There are 5 more Canadians with condition X in the lowest income quintile than in the highest income quintile.

The **variance** was calculated using the following formula:

Variance (Rate difference) = Variance (Rate_{Q1}) + Variance (Rate_{Q5})

The RD 95% confidence interval is given by

Rate difference \pm 1.96 $\sqrt{Variance (Rate difference)}$.

To learn more about measuring and reporting on health inequalities, see CIHI's <u>Measuring</u> <u>Health Inequalities: A Toolkit</u>.

Suppression and cautionary notes for results

The CV for each indicator result was used for suppression. If the CV was greater than 33.3%, then the result was suppressed. If the CV was between 16.7% and 33.3%, then a note was added to use with caution.

If a CSD had a suppressed result for any of the 5 neighbourhood income quintile groups, then all the rates for all income quintiles, as well as RR and RD results, were also suppressed.

Where the confidence interval of the rate or summary measure extends below 0, the confidence interval was capped at 0.

Results for CSDs that align with First Nations reserve boundaries have not been released. We continue to work with medical officers of health, First Nations organizations and First Nations to determine the next steps for including data on First Nations reserve CSDs.

Some results have been suppressed to prevent residual disclosure.

Appendix: Navigating CIHI's Indicator Library

Click the links in the table <u>Details for hospitalization and day surgery indicators</u> to access each indicator's web page in CIHI's Indicator Library. The link will take you to the Summary View tab.

Canadian Institute for Hea Better Data. Better Decisions. Healthi	alth Information er Canadians.			<u>Français</u>
Indicator Library Ab	out This Tool Resou	irces		
Hospitalizations Entirely Cau Summary View	sed by Alcohol			X III
Name	Hospitalizations Entirely Caused by A	Alcohol		
Short/Other Names	100% Alcohol-Attributable Hospitaliza	ations (AAHs)		
Description	Age-standardized rate of hospitalizat For further details, please see the Ge	tions with conditions with conditions	ions that are wholly (100%) attributable to alcohol per 100,000 population age 10 and ogy. Notes.	I older.
Interpretation	Lower rates are desirable.			
HSP Framework Dimension	Health System Outcomes: Improve h	nealth status of C	Canadians	
Areas of Need	Staying Healthy			
Geographic Coverage	All provinces/territories			
Reporting Level/Disaggregation	National, Province/Territory, Region			
Indicator Results	Accessing Indicator Results on Your	Health System: I	In Depth	
Contact us at <u>hsp@chi.ca</u> ©CIHI 1995 – 2018				

Click the Detailed View tab to see more information about the calculation of the indicator.

Canadian Institute for Health Information Better Data. Better Decisions. Healthier Canadians.				<u>Français</u>
Indicator Library	About This Tool	Resources		
	ľ			
Hospitalizations Entirely Ca	used by Alcoho	1		X III
▼ Identifying Incomation				
Nai	Hospitalizations Entirely	Caused by Alcohol		
Short/Other Nam	100% Alcohol-Attributable Hospitalizations (AAHs)			
▼ Indicator Description and Calculation				
Descripti	Age-standardized rate of For further details, please	f hospitalizations with c	onditions that are wholly (100%) attributable to alcohol per 100,000 population age 10 a <u>todology Notes</u> .	ind older.
Calculation: Description	(Total number of hospita and older) × 100,000 (a	lizations with wholly alc ge-adjusted)	ohol-attributable conditions among patients age 10 and older + Total mid-year populatio	on age 10
Calculation: Geographic Assignme	Unit of analysis: Single	discharge		
Calculation: Type of Measureme	nt Rate - Rate per 100,000			
Calculation: Adjustment Appli	d Age-adjusted			
Calculation: Method of Adjustme	Direct Standardization Standard Population: Canada 2011			

References

- 1. Statistics Canada. <u>Dictionary, Census of Population, 2016</u>. Accessed August 19, 2019.
- 2. Statistics Canada. <u>Canadian Community Health Survey (CCHS) Annual Component,</u> <u>User Guide: 2008 Microdata Files</u>. 2009.



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