Data and Analysis Methodology
Reducing Gaps in Health:
A Focus on Socio-Economic Status
in Urban Canada
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Brief Report Synopsis

The Canadian Population Health Initiative (CPHI) report, *Reducing Gaps in Health: A Focus on Socio-Economic Status in Urban Canada*, explored the links between socio-economic status (SES) and health in urban Canada. Results demonstrated that links between SES and health exist in Canada’s census metropolitan areas (CMAs), where locations characterized by low SES are more likely to experience poorer health than locations characterized by high SES.

Data Sources

Two groups of age-standardized health-related indicators were used to examine gaps in health as a result of SES in 15 of Canada’s CMAs. These were hospitalization rates for a number of medical conditions and percentages of self-reported health. These rates and percentages identified differences in status between those from low-, average- and high-SES groups living in 15 Canadian CMAs. Data for this report were obtained from various sources, including:

- Institut national de santé publique du Québec (INSPQ) Deprivation Index;
- 2001 and 2006 Canadian Census Profile (Statistics Canada);
- Discharge Abstract Database (DAD), Canadian Institute for Health Information (CIHI);
- National Trauma Registry (NTR), CIHI; and
- Canadian Community Health Survey (CCHS), cycles 2.1 (2003) and 3.1 (2005) combined,¹ Statistics Canada.

Census of Canada

The census provides reliable estimates of the Canadian population and dwelling counts of provinces, territories and local municipal areas. Demographic, social and economic characteristics of the population, along with information on housing within small geographic areas, were provided. This information supports the planning, administration, policy development and evaluation activities of government across all levels, as well as activities of data users in the private sector. The census provides an archival account of how populations, communities and the country changes over time.

Statistics Canada provided population counts at the dissemination area (DA) level, broken down by five-year age groups for census 2001 and census 2006 (population counts between census years were not available through Statistics Canada and were thus estimated by CIHI, described in more detail below). The age groups were as follows:

- 0 to 4
- 5 to 9
- 10 to 14
- 15 to 19
- 20 to 24
- 25 to 29
- 30 to 34
- 35 to 39
- 40 to 44
- 45 to 49
- 50 to 54
- 55 to 59
- 60 to 64
- 65 to 69
- 70+

¹ Statistics Canada.
Discharge Abstract Database, CIHI

DAD provides information on hospital discharges across Canada. These data are provided directly to CIHI from participating hospitals from all provinces and territories excluding Quebec. For this report, Quebec’s crude hospitalization rates were obtained from the INSPQ, and the age-standardization of these rates was calculated by the Health Indicators department at CIHI.

DAD was used to extract hospitalization cases based on their most responsible diagnosis (except for injuries), representing the diagnosis responsible for the greatest portion of the patient’s length of stay in hospital. Only acute care cases were used in this report, thereby excluding hospitalization rates for long-term care facilities, rehabilitation and psychiatric facilities, as well as day surgery. Following is a description of the CIHI indicators examined in this report which were selected from DAD (consult the glossary in Appendix E of the report for the definition of the indicators):

Ambulatory Care Sensitive Conditions (ACSC) (Under 75 Years of Age)

Age-standardized acute care hospitalization rate for conditions where appropriate ambulatory care prevents or reduces the need for readmission to hospital, per 100,000 population under 75 years of age, by three SES groups (low, average and high).

*Method of Calculation*

\[(\text{Total number of acute care hospital admissions for ACSC under 75 years of age for each SES group/Total population under 75 years of age in that SES group}) \times 100,000 \text{ (age-standardized)}\]

Diabetes (All Ages)

Age-standardized acute care hospitalization rate for diabetes, per 100,000 population, by three SES groups (low, average and high).

*Method of Calculation*

\[(\text{Total number of acute care hospitalizations due to diabetes for each SES group/Total population in that SES group}) \times 100,000 \text{ (age-standardized)}\]

Chronic Obstructive Pulmonary Disease (COPD) (20 Years of Age or Older)

Age-standardized acute care hospitalization rate for COPD, per 100,000 population 20 years of age or older, by three SES groups (low, average and high).

*Method of Calculation*

\[(\text{Total number of acute care hospitalizations for COPD 20 years of age or older for each SES group/Total population 20 years of age or older in that SES group}) \times 100,000 \text{ (age-standardized)}\]

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i. See Appendix A for the complete list of the most responsible diagnosis codes for each indicator.
Asthma in Children (Under 20 Years of Age)
Age-standardized acute care hospitalization rate for asthma, per 100,000 population under 20 years of age, by three SES groups (low, average and high).\(^3\)

*Method of Calculation*
(Total number of acute care hospitalizations for asthma under 20 years of age for each SES group/Total population under 20 years of age in that SES group) \(\times 100,000\) (age-standardized).\(^3\)

Mental Health (All Ages)
Age-standardized acute care hospitalization rate for mental illness, per 100,000 population, by three SES groups (low, average and high).\(^3\)

*Method of Calculation*
(Total number of acute care hospitalizations due to mental illness for each SES group/Total population in that SES group) \(\times 100,000\) (age-standardized).\(^3\)

Anxiety Disorders (All Ages)
Age-standardized acute care hospitalization rate for anxiety disorders, per 100,000 population, by three SES groups (low, average and high).\(^3\)

*Method of Calculation*
(Total number of acute care hospitalizations due to anxiety disorders for each SES group/Total population in that SES group) \(\times 100,000\) (age-standardized).\(^3\)

Affective Disorders (All Ages)
Age-standardized acute care hospitalization rate for affective disorders, per 100,000 population, by three SES groups (low, average and high).\(^3\)

*Method of Calculation*
(Total number of acute care hospitalizations due to affective disorders for each SES group/Total population in that SES group) \(\times 100,000\) (age-standardized).\(^3\)

Substance-Related Disorders (All Ages)
Age-standardized acute care hospitalization rate for substance-related disorders, per 100,000 population, by three SES groups (low, average and high).\(^3\)

*Method of Calculation*
(Total number of acute care hospitalizations due to substance-related disorders for each SES group/Total population in that SES group) \(\times 100,000\) (age-standardized).\(^3\)
Low Birth Weight (Excludes Babies Less than 500 Grams Due to Data Quality Concerns) (Newborns)
Rate of low birth weight per 100 live births in acute care institutions, by three SES groups (low, average and high).³

Method of Calculation
(Total number of live births with a birth weight less than 2,500 grams for each SES group/Total number of all live births in that SES group) * 100.³

National Trauma Registry, CIHI
National data on injuries in Canada are provided by the NTR.⁴ Statistics came from the Hospital Morbidity Database and from provincial trauma registries or trauma centres across Canada.⁴ While supporting CIHI’s mandate, the NTR serves many functions. Among others, the NTR gathers and analyzes summary data discharges and deaths, contributes to the reduction of trauma and fatalities by sharing data with researchers examining national injury epidemiology and facilitates injury comparisons both provincially and internationally.⁴ Following is a description of the CIHI indicators examined in this report which were selected from the NTR ii (consult the glossary of the report in Appendix E for the definition of the indicators):

Injuries (All Ages)
Age-standardized rate of acute care hospitalization due to injury resulting from the transfer of energy (excluding poisoning and other non-traumatic injuries), per 100,000 population, by three SES groups (low, average and high).³

Method of Calculation
(Total number of acute care hospitalizations due to injury for each SES group/Total population in that SES group) * 100,000 (age-standardized).³

Land Transport Accidents (LTA) (All Ages)
Age-standardized rate of acute care hospitalization due to injury resulting from LTA, per 100,000 population, by three SES groups (low, average and high).³

Method of Calculation
(Total number of acute care hospitalizations due to injury from LTA for each SES group/Total population in that SES group) * 100,000 (age-standardized).³

ii. See Appendix A for the complete list of the most responsible diagnosis codes for each indicator.
Unintentional Falls (All Ages)
Age-standardized rate of acute care hospitalization due to injury resulting from unintentional falls, per 100,000 population, by three SES groups (low, average and high).³

Method of Calculation
(Total number of acute care hospitalizations due to injury from falls for each SES group/Total population in that SES group) * 100,000 (age-standardized).³

Injuries in Children (Under 20 Years of Age)
Age-standardized rate of acute care hospitalization due to injury resulting from the transfer of energy (excluding poisoning and other non-traumatic injuries), per 100,000 population under 20 years of age, by three SES groups (low, average and high).³

Method of Calculation
(Total number of acute care hospitalizations due to injury for people under 20 years of age for each SES group/Total population under 20 years of age in that SES group) * 100,000 (age-standardized).³

Canadian Community Health Survey
(Cycles 2.1 and 3.1 Combined)¹
The CCHS supports health regions in planning, implementing and evaluating health promotion campaigns by providing estimates of health determinants, health status and health system utilization at a sub-provincial level.⁵ It provides data at the health region level⁶ on key topics for youth and adults ages 12 and over living in private-occupied dwellings. Certain groups are excluded; thus, the CCHS covers approximately 98% of the Canadian population ages 12 and over.

A subset of indicators was chosen from the CCHS based on relevance to SES and health in urban Canada. This subset included the following eight self-reported health indicators:

Self-Rated Health (Ages 12 and Over)¹
Population (ages 12 and over) who rated their own health status as being either excellent or very good. Self-reported health is an indicator of overall health status. It can reflect aspects of health not captured in other measures, such as incipient disease, disease severity, aspects of positive health status, physiological and psychological reserves and social and mental function.

Source
Variable used for CCHS 2.1: GENCDHDI = (3, 4) very good or excellent self-rated health.
Variable used for CCHS 3.1: GENEDHDI = (3, 4) very good or excellent self-rated health.
Physical Inactivity (Ages 12 and Over)\(^1\)
Population (ages 12 and over) reporting a level of physical activity considered inactive based on their responses to questions about the frequency, duration and intensity of their participation in leisure-time physical activity over the past three months.

**Source**
Variable used for CCHS 2.1: PACDPAI = 3 leisure-time physically inactive.
Variable used for CCHS 3.1: PACEDPAI = 3 leisure-time physically inactive.

Smoking (Ages 12 and Over)\(^1\)
Population (ages 12 and over) who reported being a current smoker on either a daily or occasional basis.

**Source**
Variable used for CCHS 2.1: SMKCDSTY = (1, 2, 3) daily or occasional smoker.
Variable used for CCHS 3.1: SMKEDSTY = (1, 2, 3) daily or occasional smoker.

Alcohol Intake (Alcohol Binging) (Ages 12 and Over)\(^1\)
Population (ages 12 and over who reported being a current drinker) having five or more drinks on one occasion, 12 or more times a year.

**Source**
Variable used for CCHS 2.1: ALCC_3 \(\leq (3, 4, 5, 6)\) at least five or more drinks on one occasion in the last 12 months.
Variable used for CCHS 3.1: ALCE_3 \(\leq (3, 4, 5, 6)\) at least five or more drinks on one occasion in the last 12 months.

Body Mass Index (BMI) (Overweight or Obese) (Ages 18 and Over)\(^1\)
Population (ages 18 and over) with a BMI of 25 or greater. According to World Health Organization and Health Canada guidelines, a BMI of 25 or greater is classified as overweight and is associated with increased health risk. A BMI of 30 or greater is classified as obese and is associated with high health risk. BMI is calculated from weight and height collected from respondents by dividing body weight (in kilograms) by height (in metres squared).

**Source**
Variable used for CCHS 2.1: HWTCDISW = (3, 4, 5, 6) BMI—self-reported overweight or obese.
Variable used for CCHS 3.1: HWTEDISW = (3, 4, 5, 6) BMI—self-reported overweight or obese.
Risk-Factor Index (Risk Factors, Including Self-Reported Physical Inactivity, BMI, Smoking and/or Alcohol Intake) (Ages 18 and Over)\(^1\)

Population (ages 18 and over) with three or more of the following variables: physical inactivity, overweight or obese, current daily or occasional smoker and current drinker having five or more drinks on one occasion, 12 or more times a year.

Source

Influenza Immunization (Ages 65 and Over)\(^1\)

Population (ages 65 and over) who report that they received an influenza immunization (flu shot) within the last 12 months.

Source

Variable used for CCHS 2.1: FLUC\(_{160} = 1\) and FLUC\(_{162} = 1\) influenza immunization, less than one year ago.

Variable used for CCHS 3.1: FLUE\(_{160} = 1\) and FLUE\(_{162} = 1\) influenza immunization, less than one year ago.

Participation and Activity Limitation (Activity Limitation) (Ages 65 and Over)\(^1\)

Population (ages 65 and over) who report being limited in selected activities (home, school, work and other) because of a physical condition, mental condition or health problem which has lasted or is expected to last six months or longer.

Source

Variable used for CCHS 2.1: RACCDPAL = (1, 2) participation or activity limitation, some or often.

Variable used for CCHS 3.1: RACEDPAL = (1, 2) participation or activity limitation, some or often.

These rates were age-standardized to the 1991 population of Canada (described later in more detail).

Socio-Economic Status: INSPQ Deprivation Index

The INSPQ Deprivation Index categorizes DAs into two sets of quintile groups: one for the material components of deprivation (based on average income, percent without high school graduation and the employment ratio) and the other for the social components (percent of single-parent families, percent of persons living alone and percent of persons divorced, widowed or separated). In each quintile group, Q1 represents the 20% least deprived and Q5 represents the 20% most deprived.

For this report, CPHI categorized DAs with particular combinations of material and social quintile scores into one of the following three groups: high SES, average SES or low SES. DAs with material and social combinations found in the top left (shaded) portion of the matrix below were categorized by CPHI as high SES. Dissemination areas found with material and social combinations found in the bottom right (shaded) portion of the matrix were categorized by CPHI as low SES. All other DAs were categorized as average SES.
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### 2006 Canadian Census: Community Profiles

Demographic and socio-economic characteristics of Canada’s urban CMAs presented in the report were obtained directly from Statistics Canada’s 2006 Community Profiles. Some of the characteristics listed below were not directly provided in the census tables and needed to be calculated from existing census data:

- Population size.
- Median family income.
- Rates of low income.
- Percent without high school graduation:
  - Method of calculation: from the 2006 census, the number of people responding having no certificate, diploma or degree in a select CMA divided by the total population ages 15 and over in that CMA, multiplied by 100.
- Unemployment rate, 2000 to 2006.
- Percent of persons living alone:
  - Method of calculation: from the 2006 census, the number of one-person households in a select CMA divided by the total population of that CMA, multiplied by 100.
- Percent of families headed by a single parent:
  - Method of calculation: from the 2006 census, the number of lone-parent families in a select CMA divided by the total number of census families of that CMA, multiplied by 100.
- Percent of persons ages 15 and over who are separated, divorced or widowed:
  - Method of calculation: from the 2006 census, the number of people in a select CMA who reported being separated but still legally married plus the number of people divorced plus the number of people widowed divided by total population ages 15 and over of that CMA, multiplied by 100.
- Percent who are children younger than 15:
  - Method of calculation: from the 2006 census, the number of children age 0 to 14 in a select CMA divided by the total population of that CMA, multiplied by 100.
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- Percent who are seniors ages 65 and over:
  - Method of calculation: from the 2006 census, the number of people ages 65 and over in a select CMA divided by the total population of that CMA, multiplied by 100.

- Percent who are immigrants arrived between 2001 and 2006:
  - Method of calculation: from the 2006 census, the number of immigrants between 2001 and 2006 in a select CMA divided by the total population of that CMA, multiplied by 100.

- Percent who are visible minorities:
  - Method of calculation: from the 2006 census, the number representing the total visible minority population of a select CMA divided by the total population for that CMA, multiplied by 100.

- Percent who are Aboriginal Peoples:
  - Method of calculation: from the 2006 census, the number of people declaring Aboriginal identity in a select CMA divided by the total Aboriginal and non-Aboriginal identity population of that CMA, multiplied by 100.

CMA Inclusion Criteria

The following 15 CMAs chosen for this report provide a broad geographic representation of Canada’s urban areas, are some of Canada’s largest CMAs and encompass Urban Public Health Network (UPHN) member cities.

1. Victoria
2. Vancouver
3. Calgary
4. Edmonton
5. Saskatoon
6. Regina
7. Winnipeg
8. London
9. Hamilton
10. Toronto
11. Ottawa–Gatineau
12. Montréal
13. Québec
14. Halifax
15. St. John’s

New Brunswick, Prince Edward Island, Nunavut, the Northwest Territories and the Yukon Territory were excluded from the analyses, given the smaller populations of the two New Brunswick CMAs (Moncton and Saint John) and the absence of CMAs in Prince Edward Island, Nunavut, the Northwest Territories and the Yukon.

As this report focused on SES and health in urban Canada, rural DAs were not included. The Postal Code Conversion File (PCCF) for 2006, which provides a link between six-character postal codes and standard 2001 census geographic areas (including DAs), was used to identify which DAs were considered urban areas for inclusion in this report.
Statistical area classification codes group together census subdivisions based on whether they are part of a CMA, a census agglomeration (CA), a CMA- or CA-influenced zone or the territories. Census subdivisions outside a CMA are identified as one of four 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 geographical boundaries and zones were excluded from the analyses, as these were not CMAs:

- **000** = Territories.
- **996** = Strongly influenced zone (more than 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).
- **999** = No influence zone (fewer than 40 or none of the residents work in a CMA).

DAs with the following urban area–rural area type (UARAtype) codes, which indicate the relationship of the urban area to the CMA structure, were not included in the analyses:

1. Rural fringe inside CMA/CAs (code 3);
2. Urban areas outside CMA/CAs (code 4); and
3. Rural fringe outside CMA/CAs (code 5).

DAs with the following UARAtype were included in the analyses:

1. Urban core (code 1);
2. Urban fringe (code 2); and
3. Secondary urban core (code 6).

A UARAtype code “0” was linked to some DAs, requiring verification of the delivery mode type (DMT) assigned to the DA by the PCCF to ascertain whether these urban areas had anyone living within their boundaries. Dissemination areas with a UARAtype code “0” and the accompanying DMT codes were identified as urban residential and were included in the analyses:

- **A**—Delivery to block-face address;
- **B**—Delivery to an apartment building;
- **E**—Delivery to a business building;
- **J**—General delivery; and
- **K**—Delivery to a post office box (not a community mail box).

This filtering method resulted in the inclusion of 30,294 urban DAs comprising the 15 CMAs for this report.
The following table presents the number of DAs in each of the 15 CMAs, including a detailed breakdown by SES group:

<table>
<thead>
<tr>
<th>CMA Name</th>
<th>Number of Low-SES DAs</th>
<th>Number of Average-SES DAs</th>
<th>Number of High-SES DAs</th>
<th>Total Number of DAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td>53</td>
<td>409</td>
<td>91</td>
<td>553</td>
</tr>
<tr>
<td>Vancouver</td>
<td>341</td>
<td>2,604</td>
<td>602</td>
<td>3,547</td>
</tr>
<tr>
<td>Calgary</td>
<td>205</td>
<td>1,182</td>
<td>401</td>
<td>1,788</td>
</tr>
<tr>
<td>Edmonton</td>
<td>360</td>
<td>1,037</td>
<td>235</td>
<td>1,632</td>
</tr>
<tr>
<td>Saskatoon</td>
<td>92</td>
<td>269</td>
<td>91</td>
<td>452</td>
</tr>
<tr>
<td>Regina</td>
<td>69</td>
<td>207</td>
<td>110</td>
<td>386</td>
</tr>
<tr>
<td>Winnipeg</td>
<td>240</td>
<td>697</td>
<td>230</td>
<td>1,167</td>
</tr>
<tr>
<td>London</td>
<td>175</td>
<td>467</td>
<td>131</td>
<td>773</td>
</tr>
<tr>
<td>Hamilton</td>
<td>226</td>
<td>700</td>
<td>249</td>
<td>1,175</td>
</tr>
<tr>
<td>Toronto</td>
<td>932</td>
<td>5,551</td>
<td>1,557</td>
<td>8,040</td>
</tr>
<tr>
<td>Ottawa–Gatineau</td>
<td>212</td>
<td>1,153</td>
<td>483</td>
<td>1,848</td>
</tr>
<tr>
<td>Montréal</td>
<td>1,136</td>
<td>4,058</td>
<td>1,250</td>
<td>6,444</td>
</tr>
<tr>
<td>Québec</td>
<td>179</td>
<td>920</td>
<td>284</td>
<td>1,383</td>
</tr>
<tr>
<td>Halifax</td>
<td>90</td>
<td>471</td>
<td>166</td>
<td>727</td>
</tr>
<tr>
<td>St. John’s</td>
<td>59</td>
<td>256</td>
<td>64</td>
<td>379</td>
</tr>
<tr>
<td>Total</td>
<td>4,369</td>
<td>19,981</td>
<td>5,944</td>
<td>30,294</td>
</tr>
</tbody>
</table>

**Methods**

**INSPQ Deprivation Index**

The INSPQ Deprivation Index for health, originally published by Robert Pampalon and Guy Raymond in 2000, emphasizes the material and social aspects of deprivation. As the index is intended to serve as a proxy for individual-level measures, the geographical unit to which it is applied must be as small as possible. That is, the socio-economic categorization of a geographical area by this measure should be generalizable to the people living in that area. The smaller the area, the stronger the likelihood that people living in the area share similar socio-economic conditions. As such, the basic unit on which the Deprivation Index is based is Statistics Canada’s DA—the smallest geographical unit of the census. The index combined six indicators related to a high number of health and welfare issues associated with either social or material deprivation and that were available at the enumeration area level. (Statistics Canada later replaced the enumeration area with the DA.) The six indicators are:

1. The proportion of people who have not graduated from high school;
2. The ratio of employment to population;
3. Average income;
4. Proportion of persons who are separated, divorced or widowed;
5. Proportion of single-parent families; and
6. Proportion of people living alone.

The INSPQ conducted a principle-component analysis of the Deprivation Index indicators, which revealed two components: the material component, consisting of variations in education, employment and income; and the social component, consisting of variations in the proportion of widowed, separated and divorced people, single-parent families and persons living alone. For each component, DAs were ranked on the basis of their factor score and then arranged in quintiles ranging from one (representing the 20% least deprived portion of the selected population) to five (representing the 20% most deprived). These material and social quintiles were then cross-tabulated, creating a matrix of 25 distinct cells in which DAs were classified according to their scores on both dimensions. For further details on INSPQ's Deprivation Index, including reliability and validity testing, see R. Pampalon and G. Raymond.

Characterization of SES for the 2006 census DAs using the INSPQ Deprivation Index was not available at the time of the analyses for this report. As such, CIHI assigned SES groups to the 2006 DAs based on the 2001 census SES assignment with the aid of the Dissemination Area Correspondence File, which is a tabular product that describes the relationship between the 2006 DAs and the 2001 DAs (Statistics Canada catalogue number 92-156-XBB). Therefore, the 2006 SES assignment was based on the assumption that the SES status of the 2001 DAs remained unchanged through to the 2006 census. Mapping of the 2001 SES groups to the 2006 SES groups was not perfect; thus certain rules were applied to help ensure that the mapping was as close to reality as possible. More specifically, in some instances two DAs in 2001 became one DA in 2006. In these cases, SES group assignment from the more populous 2001 DA was assigned to the 2006 DA. In other cases, one DA in 2001 became two DAs in 2006. In these cases, both 2006 DAs were assigned the same SES grouping as the 2001 DA. In other cases, more than two 2001 DAs became one DA in 2006. In these instances, the SES group assignment for the larger numbers of DAs in 2001 was assigned to the 2006 DA.

MapInfo Professional (a geographic information systems application) was used to verify that the DA assignment between the 2001 and 2006 census years remained stable. Specifically, the 2006 DA boundaries were layered on top of the 2001 DA boundaries to ensure the SES group assignment matched for the two different census years.

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iii. Due to the assumption that DA SES status did not change over time, the results should be interpreted with caution and only hold true under this assumption.
Population Estimates

As this report provided age-standardized hospitalization rates for the years 2003–2004, 2004–2005 and 2005–2006, population counts for these years were needed. However, population counts between census years at the DA level were not available through Statistics Canada. Therefore, we estimated the population counts by CMA and SES group using DA-level population counts of the 2001 and 2006 census (provided by Statistics Canada) as well as from the 2001 CMA boundaries. This estimate was based on the assumption that the increase or decrease in population was linear. For example, in Calgary, the population of people in SES group 1, male and age group 1 increased from 2,000 to 3,000. This is a 50% increase for the five-year period (the time period between the two censuses) which—based on the assumption of linear population changes—translates to a 10% increase for each year. For this example, the population was estimated to be 2,200 in 2002, 2,400 in 2003, 2,600 in 2004 and 2,800 in 2005.

Indicators

This report examined differences in age-standardized hospitalization rates and self-reported health indicators, as well as the percentage of low birth weight (LBW) babies among the different SES groups comprising the 15 urban CMAs. As mentioned above, data were collected from two different sources: 1) CIHI provided age-standardized hospitalization rates per 100,000 people for 12 different medical conditions (extracted from DAD and the NTR) as well as the percentage of LBW babies per 100 live births; and 2) a subset of Statistics Canada indicators from the CCHS provided data on self-reported health by respondents ages 12 and over on eight indicators. CIHI indicators are referred to herein as “hospitalization indicators,” whereas Statistics Canada indicators are referred to as “self-reported health indicators.”

Hospitalization indicators were collected for 2003–2004 to 2005–2006, as well as the pooled data across those years. Since hospitalization rates were very consistent for the three years, only the data pooled from those three years appeared in the report.

Patient postal codes were used to determine hospitalization rates per CMA. For example, if a resident from the Hamilton CMA was hospitalized in the Toronto CMA, that particular hospitalization was counted for the Hamilton CMA and not the Toronto CMA.

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iv. The population estimates were based on actual census population counts, so the results may not be comparable to those calculated using post-censal population estimates.
Analyses

Age-Standardization

For all hospitalization indicators, the rates were standardized per 100,000 people, with the exception of LBW (presented per 100 live births). The standardized rates were adjusted by age using a direct method of standardization based on the July 1, 1991, Canadian population. An age-standardized rate is a weighted average of the age-specific rates, where the weights are the proportions of a standard population in the corresponding age groups. It represents what the crude rate would have been in the study population if that population had the same age distribution as the standard population. The potential confounding effect of age is removed when comparing age-standardized rates computed using the same standard population.

All indicators (except for low birth weight) were age-standardized rates. The formula for this calculation is as follows:

\[
r = \sum_{i=1}^{n} r_i = \sum_{i=1}^{n} \left( \frac{\text{count}_i}{\text{population}_i} \times \frac{\text{cdn}_\text{standard}_1991_i}{\text{cdn}_\text{standard}_1991} \right)
\]

Where:

\(n\) = the number of age groups.

\(\text{cdn}_\text{standard}_1991_i\) = population in the \(i\)th age group of the standard.

\(\text{cdn}_\text{standard}_1991\) = total standard population.

The terms \(\frac{\text{cdn}_\text{standard}_1991_i}{\text{cdn}_\text{standard}_1991}\) are the weights in the calculation of the weighted sum \(r\) are considered to be constants.

Statistical Comparisons of Indicators

This report examined whether or not statistical differences in indicators existed between SES groups within a CMA, and if differences existed between SES groups and the pan-Canadian rates. To do this, 95% confidence levels, which refer to the range of values where the true rate falls (95% means 19 times out of 20), were calculated and presented for all indicators including the LBW percentage. The lower-confidence limit represents the low number of this range and the upper-confidence limit represents the high number in the range. This range is influenced by the number of cases and by the size of the population. The rates by SES groups were pairwise compared by calculating the rate difference and 95% confidence level for the difference. If this confidence level does not include 0, we concluded that the two rates were statistically significantly different with 95% certainty; otherwise, we could not make the conclusion.

As the same methodology defining SES was applied to all DAs included in this report, within-CMA comparisons and CMA-to-pan-Canadian comparisons by SES were possible.
Calculating the Confidence Interval\textsuperscript{13}

The indicator \((r)\) is a weighted sum of Bernoulli distributions. The mean and variance of the Bernoulli distribution are:

\[
E(\hat{p}) = p, \quad \text{var}(\hat{p}) = \frac{p(1 - p)}{n}, \quad \text{where}
\]

\[
\hat{p} = \frac{s}{n}, \text{the estimated proportion}
\]

\[
s: \text{the number of successes}
\]

\[
n: \text{the number of trials}
\]

\[
p: \text{the true proportion successes}
\]

In this case, each \(\frac{\text{count}_{i}}{\text{population}_{i}}\) is an estimated proportion \(\hat{p}_i\), with \(\text{count}_{i}\) corresponding to the \textit{successes}, and \(\text{population}_{i}\) corresponding to the \textit{number of trials}.

The variance of a weighted sum of independent random variables is also a weighted sum of the variables’ variances, with the original weights squared.

So for the variance of \(r\):

\[
\text{Var}(r) = \sum_{i=1}^{k} \left[ \frac{\text{cdn standard 1991}_{i}^2}{\text{cdn standard 1991}_{i}} \right] \left( \frac{\text{count}_{i}}{\text{population}_{i}} \right) \left( 1 - \frac{\text{count}_{i}}{\text{population}_{i}} \right) / \text{population}_{i}
\]

(making the usual substitution of \(\hat{p}_i\) for \(p_i\)).

Note that by the central limit theorem,

\[
Z = \frac{(r - R)}{\sqrt{\text{Var}(r)}}, \quad \text{where}
\]

\[
R = E(r)
\]

has approximately a standard normal distribution and hence is (approximately) a pivot variable for \(R\). Hence an approximate 95% confidence interval for \(R\) (the true value of the indicator) is given as follows:

\[
[ r - 1.96 \sqrt{\text{Var}(r)}, \quad r + 1.96 \sqrt{\text{Var}(r)} ]
\]

So, the 95% confidence interval for the age standardized indicator is \(r \pm 1.96 \times SD\), where

\[
SD = \sqrt{\sum_{i=1}^{k} \left[ \frac{\text{cdn standard 1991}_{i}}{\text{cdn standard 1991}_{i}} \right]^2 \left( \frac{\text{count}_{i}}{\text{population}_{i}} \right) \left( 1 - \frac{\text{count}_{i}}{\text{population}_{i}} \right) / \text{population}_{i}}
\]
Calculating Significance

The difference between two rates was calculated using significance testing. Assuming $x$ is the difference between two rates, the 95% confidence interval of $x$ will not include 0. In this instance, we can conclude that the difference between the two rates is statistically significant with 95% certainty. Otherwise, the conclusion of a statistically significant difference cannot be made.

Significance Test for LBW

Calculating Significance Between Two SES Groups’ Rates

Since the different SES groups are independent, the LBW rates of different SES groups are also statistically independent. Let $r_1$ and $r_2$ be the two rates, and let $n$ and $m$ be the numbers of live births from the two SES groups respectively. By using the central limit theorem, we get the 95% confidence interval for $r_1 - r_2$ as follows:

$$(r_1 - r_2) \pm 1.96 \sqrt{\frac{r_1}{n} (1 - r_1) + \frac{r_2}{m} (1 - r_2)}.$$

Here, $\hat{r}_1$ and $\hat{r}_2$ are the estimators of $r_1$ and $r_2$.

Calculating Significance Between the CMA Rate and the Pan-Canadian Rate

In this situation, the covariance needs to be taken into account, since the two rates are not independent. Again, let $r_1$ and $r$ be the CMA rate and overall urban rate and let $n$ and $m$ be the respective numbers of live birth cases. The 95% confidence interval for $r_1 - r$ is as follows:

$$(r_1 - r) \pm 1.96 \sqrt{\frac{r_1}{n} (1 - r_1) + \frac{r}{m} (1 - r) - 2 \frac{r_1}{m} (1 - r_1)}.$$

Note that the third term under the square root sign is the covariance term.
Significance Test for Age-Standardized Rates\textsuperscript{13}

Calculating Significance Between the CMA Rate and the Pan-Canadian Rate

In this case, the different SES groups and age groups are independent. Let \( r_1 \) and \( r \) represent the estimates of two SES group rates. The 95% confidence interval for the difference between the true values of these rates is

\[
r_1 - r_2 \pm 1.96 \sqrt{ \sum_i w_{si}^2 m_{i1} (1 - m_{i1}) / n_{i1} + \sum_i w_{si}^2 m_{i2} (1 - m_{i2}) / n_{i2} },
\]

where:

- \( w_{si} \) are the standardizing weights: \( \frac{cdn\_standard\_1991_i}{cdn\_standard\_1991} \), so that \( \sum_i w_{si} = 1 \);
- \( m_{i1} \) is the specific rate for the \( ith \) age group of the first SES group;
- \( m_{i2} \) is the specific rate for the \( ith \) age group of the second SES group;
- \( n_{i1} \) is the population size for the \( ith \) age group of the first SES group; and
- \( n_{i2} \) is the population size for the \( ith \) age group of the second SES group.

Significance Test Between the CMA Rate and the Overall Urban Rate\textsuperscript{13}

In this case, we need to consider the covariance because of the overlap of the populations. If \( r \) and \( r_1 \) are estimates of the overall urban standardized rate (standardized by age) and a DA standardized rate respectively, and assuming that they were standardized with respect to the same reference population, the 95% confidence interval for the difference between the true values of these rates is:

\[
r_1 - r \pm 1.96 \sqrt{ \left[ \sum_i w_{si}^2 m_{i1} (1 - m_{i1}) / n_{i1} + \sum_i w_{si}^2 m_{i} (1 - m_{i}) / n_{i} - 2 \sum_i w_{si}^2 m_{i1} (1 - m_{i1}) / n_{i1} \right] },
\]
where, similar to the above situation:

\[ w_{si} \text{ is the standard weight so that } \sum w_{si} = 1; \]

\[ m_{ii} \text{ is the specific rate for the } ith \text{ age group of the CMA;} \]

\[ m_i \text{ is the specific rate for the } ith \text{ age group of the overall urban;} \]

\[ n_{ii} \text{ is the population size for the } ith \text{ age group of the CMA;} \text{ and} \]

\[ n_i \text{ is the population size for the } ith \text{ age group of the overall urban.} \]

Here, \[ \sum w_{si}^2 m_{ii} (1 - m_{ii}) / n_i \] is the covariance term.
Appendix A
Ambulatory Care Sensitive Conditions

Numerator:
Inclusion Criteria:

Any most responsible diagnosis code (MRDx) of:

- Grand mal status and other epileptic convulsions
  
  ICD-9
  345
  ICD-10-CA
  G40, G41

- Chronic obstructive pulmonary disease (COPD)
  - Any MRDx code of COPD
    
    ICD-9
    491, 492, 494, 496
    ICD-10-CA
    J41, J42, J43, J44, J47
  
  - MRDx of acute lower respiratory infection, only when a secondary diagnosis* of
    J44 in ICD-10-CA or 496 in ICD-9 is also present
    
    ICD-9
    480 to 486, 466, 487.0
    ICD-10
    J10.0, J11.0, J12 to J16, J18, J20, J21, J22

- Asthma
  
  ICD-9
  493
  ICD-10-CA
  J45

- Heart failure and pulmonary edema
  
  ICD-9
  428, 518.4
  ICD-10-CA
  I50, J81
  Excluding cases with the following surgical procedures:†
  
  CCP
  48.1, 49.5, 48.02, 48.03, 49.71, 49.72, 49.73, 49.82, 49.86
  CCI
  1.IJ.50, 1.IJ.57.GQ, 1.HZ.85, 1.IJ.76, 1.HB.53, 1.HD.53, 1.HZ.53, 1.HB.55,
  1.HD.55, 1.HZ.55, 1.HB.54, 1.HD.54
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- Hypertension
  
  **ICD-9**
  401.0, 401.9, 402.0, 402.1, 402.9
  
  **ICD-10-CA**
  I10.0, I10.1, I11

  Excluding cases with the following surgical procedures:

  **CCI**
  1.IJ.50, 1.IJ.57.GQ, 1.HZ.85, 1.IJ.76, 1.HB.53, 1.HD.53, 1.HZ.53, 1.HB.55, 1.HD.55, 1.HZ.55, 1.HB.54, 1.HD.54

- Angina
  
  **ICD-9**
  411, 413
  
  **ICD-10-CA**
  I20, I23.82, I24.0, I24.8, I24.9

  Excluding cases with the following surgical procedures:

  **CCI**
  1.^, 2.^, 5.^ (that is, any procedure from CCI section 1, 2, 5)

- Diabetes
  
  **ICD-9**
  250.0, 250.1, 250.2, 250.7, 250.9
  
  **ICD-10-CA**

**Exclusion Criteria:**

Individuals ages 75 and over.

Death before discharge.

**Notes**

* Secondary diagnosis refers to a diagnosis other than most responsible.
† Code may be recorded in any position. Procedures coded as cancelled, previous and abandoned after onset are excluded.


**Sources**

Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Diabetes

Numerator:

Inclusion criteria:

- Any MRDx code of
  - ICD-9
    - 250
  - ICD-10-CA
    - E10, E11, E13, E14

Note


Sources

Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Chronic Obstructive Pulmonary Disease

Numerator:

Inclusion criteria:

- Any MRDx code of COPD
  - ICD-9
    491, 492, 494, 496
  - ICD-10-CA
    J41, J42, J43, J44, J47

- MRDx of acute lower respiratory infection, only when a secondary diagnosis* of J44 in ICD-10-CA or 496 in ICD-9 is also present
  - ICD-9
    480 to 486, 466, 487.0
  - ICD-10
    J10.0, J11.0, J12-J16, J18, J20, J21, J22

Exclusion criteria:

Individuals under 20 years of age.

Notes

* Secondary diagnosis refers to a diagnosis other than most responsible.


Sources

Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Asthma in Children (Under 20 Years of Age)\textsuperscript{3}

Numerator:

Inclusion criteria:

- Any MRDx code of:
  - ICD-9
    - 493
  - ICD-10-CA
    - J45
- Individuals under 20 years of age.

Note


Sources

Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Mental Health (All Ages)$^3$

**Numerator:**

**Inclusion criteria:**

- Any MRDx code of
  - ICD-9
    - 290 to 319
  - ICD-10-CA
    - F00 to F99
- Secondary diagnosis$^*$ of dementia, only when an MRDx of the following corresponding condition is also present:
  - Dementia in Alzheimer’s disease
    - ICD-9
      - MRDx of 331.0, with a secondary diagnosis of 290.1
    - ICD-10-CA
      - MRDx of G30, with type 3 or 6 of F00
  - Dementia in Pick’s disease
    - ICD-9
      - MRDx of 331.1, with a secondary diagnosis of 294.1
    - ICD-10-CA
      - MRDx of G31.0, with type 3 or 6 of F02.0
  - Dementia in Creutzfeldt-Jakob disease
    - ICD-9
      - MRDx of 046.1, with a secondary diagnosis of 294.1
    - ICD-10-CA
      - MRDx of A81.0, with type 3 or 6 of F02.1
  - Dementia in Huntington’s disease
    - ICD-9
      - MRDx of 333.4, with a secondary diagnosis of 294.1
    - ICD-10-CA
      - MRDx of G10, with type 3 or 6 of F02.2
  - Dementia in Parkinson’s disease
    - ICD-9
      - MRDx of 332, with a secondary diagnosis of 294.1
    - ICD-10-CA
      - MRDx of G20, with type 3 or 6 of F02.3
Dementia in HIV disease

- **ICD-9**
  MRDx of 042.9, with a secondary diagnosis of 294.1

- **ICD-10-CA**
  MRDx of B24, with type 3 or 6 of F02.4

**Notes**
* Secondary diagnosis refers to either type 3 or type 6. Since there is no diagnosis typing in Quebec data, for Quebec it refers to a diagnosis other than most responsible.


**Sources**
Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Anxiety Disorders (All Ages)³

Numerator:

Inclusion criteria:

- Any MRDx code of
  - ICD-9
    - 300.0, 300.2, 300.3, 309.2, 312.2, 308
  - ICD-10-CA
    - F40, F41, F42, F43.0, F43.1, F43.8, F43.9, F93.0 to F93.2

Note

Sources
Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Affective Disorders (All Ages)\textsuperscript{3}

**Numerator:**

**Inclusion criteria:**

- Any MRDx code of
  - **ICD-9**
    - 296, 300.4, 311
  - **ICD-10-CA**
    - F30 to F33, F34.0, F34.1, F34.8, F34.9, F38.0, F38.1, F38.8, F39

**Notes**

Affective disorder includes depression.


**Sources**

Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Substance-Related Disorders (All Ages)$^3$

**Numerator:**

**Inclusion criteria:**

- Any MRDx code of
  - **ICD-9**
    - 291, 292, 303, 304, 305
  - **ICD-10-CA**
    - F10 to F19, F55

**Note**

**Sources**
Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Low Birth Weight (Excludes Babies Less than 500 Grams Due to Data Quality Concerns) (Newborns)³

Denominator:
Inclusion criteria:
• Records with:
  – Newborns born in an acute care hospital
  – Birth weight ≥ 500 grams and ≤ 9,000 grams

Exclusion criteria:
• Records with:
  – Invalid or unknown weight
  – Stillbirths

Numerator (a subset of denominator):
Inclusion criteria:
• Records with
  – Birth weight ≥ 500 grams and ≤ 2,499 grams

Note

Sources
Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Injuries (All Ages)\textsuperscript{3}

**Numerator:**

- Any of the following diagnosis codes with a diagnosis type of 9:
  - **ICD-9**
    - E800 to E807, E810 to E838, E840 to E848, E880 to E888, E890 to E902, E906 to E910, E913 to E928, E953 to E958, E960 to E961, E963 to E968, E970 to E976, E978, E983 to E988, E990 to E998
  - **ICD-10-CA**
    - V01 to V06, V09 to V99, W00 to W45, W49 to W60, W64 to W70, W73 to W77, W81, W83 to W94, W99, X00 to X06, X08 to X19, X30 to X39, X50, X52, X58, X59, X70 to X84, X86, X91 to X99, Y00 to Y05, Y07 to Y09, Y20 to Y36

**Notes**

Poisoning, adverse effects of drugs/medicine, choking, late effects and several other conditions do not meet the definition of trauma developed by the National Trauma Registry Advisory Committee and are therefore excluded.

Children refers to individuals under 20 years of age.


**Sources**

Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Land Transport Accidents (All Ages)\textsuperscript{3}

**Numerator:**
- Any of the following diagnosis codes with a diagnosis type of 9:
  - **ICD-9**
    - E800 to E807, E810 to E829, E846 to E848
  - **ICD-10-CA**
    - V01 to V06, V09 to V89, V98, V99

**Notes**
Land transport accident–related injury includes injuries that happen to drivers, passengers of vehicles, pedestrians or persons injured in collisions when their modes of transportation are unknown. Injuries due to air, water or space transportation are not included.

**Sources**
Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
Unintentional Falls (All Ages)$^3$

**Numerator:**
- Any of the following diagnosis codes with a diagnosis type of 9:
  - **ICD-9**
    - E880 to E886, E888
  - **ICD-10-CA**
    - W00 to W19

**Note**

**Sources**
Discharge Abstract Database, Canadian Institute for Health Information; Ministère de la Santé et des Services sociaux du Québec; Census 2001 and 2006, Statistics Canada.
Injuries in Children (Under 20 Years of Age)\(^3\)

**Numerator:**
- Any of the following diagnosis codes with a diagnosis type of 9:
  - **ICD-9**
    - E800 to E807, E810 to E838, E840 to E848, E880 to E888, E890 to E902, E906 to E910, E913 to E928, E953 to E958, E960 to E961, E963 to E968, E970 to E976, E978, E983 to E988, E990 to E998
  - **ICD-10-CA**
    - V01 to V06, V09 to V99, W00 to W45, W49 to W60, W64 to W70, W73 to W77, W81, W83 to W94, W99, X00 to X06, X08 to X19, X30 to X39, X50, X52, X58, X59, X70 to X84, X86, X91 to X99, Y00 to Y05, Y07 to Y09, Y20 to Y36

**Notes**
Poisoning, adverse effects of drugs/medicine, choking, late effects and several other conditions do not meet the definition of trauma developed by the National Trauma Registry Advisory Committee and are therefore excluded.

Children refers to individuals under 20 years of age.


**Sources**
Discharge Abstract Database, Canadian Institute for Health Information; ministère de la Santé et des Services sociaux du Québec; census 2001 and 2006, Statistics Canada.
References


This publication is part of CPHI’s ongoing inquiry into the patterns of health across this country. Consistent with our broader findings, it reflects the extent to which the health of Canadians is socially determined, interconnected, complex and changing. CPHI is committed to deepening our understanding of these patterns.