

## **ABOUT MORTALITY DATA FOR CANADA**

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### **GENERAL**

#### ***Overview of Canadian History with Focus on Territorial Changes***

First traces of human habitation of the territory that now constitutes Canada date back to approximately 10,000 years. At that time, this area was populated mostly by various people who migrated from Asia via the Bering Strait. As indicated by archeological discoveries in Newfoundland, Vikings reached the East Coast in about 1,000 A.D. and, for a short time, established a settlement at L'Anse aux Meadows (the only confirmed Viking site). These Vikings expeditions are also mentioned in the early Icelandic sagas.

John Cabot, sailing under English auspices, reached the East Coast in 1497. In 1534, the Frenchman Jacques Cartier planted a cross on the Gaspé Peninsula. A search for a northwest passage to Asia was the main impetus behind these and many other voyages to the Canadian coast. Subsequently, Canadian history until 1763 is dominated by rivalry between France and England.

The first French settlement was founded in 1605 by the sieur de Monts and Samuel de Champlain at Port Royal (now Annapolis Royal, Nova Scotia) in Acadia: it comprised 44 settlers surviving from 79 who had wintered on Ile Sainte-Croix during the preceding winter. Three years later, in 1608, Quebec was founded by 28 settlers including Champlain. In 1665, the total population of New France was already 3,215 people (Statistics Canada, 1876).

French settlement in Canada did not go unchallenged. The English, moving to support their claims under Cabot's discoveries, attacked Port Royal (1614) and captured Quebec (1629). Three years later (1632), Quebec was regained by the French. A long series of wars between Britain and France broke out in Europe during the late 17<sup>th</sup> to early 18<sup>th</sup> centuries. These wars were echoed in North America by the French and Indian Wars (as they were named by American historians). One of the decisive battles took place in 1759 when Wolfe defeated Montcalm on the Plains of Abraham and Quebec was ceded to British control. A year later, Montreal was also

taken over by the British. Through the Treaty of Paris in 1763, all French North American possessions east of the Mississippi were ceded to Britain, while Louisiana was ceded to Spain.

The Royal Proclamation of 1763 imposing British institutions was met quite negatively by the French residents of Quebec. Many of its provisions, however, were reversed by the Quebec Act of 1774. This act granted important concessions to French residents, extending Quebec's territory southwards to the Ohio River and westwards to the Mississippi River. Simultaneously, this act infuriated the residents of the Thirteen Colonies (the future United States): the first act of the American Continental Congress in 1775 was the invasion of Canada even before the declaration of independence.

During the American Revolution, the Canadians remained passively loyal to the British Crown; all American attempts to take over Canada failed dismally. Over this time, Canada experienced a large influx of United Empire Loyalists from the revolting colonies; these loyalists settled in large numbers in Nova Scotia and Quebec. In 1784, part of Nova Scotia became a separate province called New Brunswick.

Residents of Quebec (predominantly Catholic French Canadians) strongly opposed the arrival of new, mostly British and Protestant, immigrants. A new Constitutional Act (1791), passed by the British Crown to address this problem, split Quebec into Upper Canada (now Ontario) and Lower Canada (now Quebec), each with their own legislature and institutions. Yet, tensions in both provinces continued. In 1839, Lord Durham, who as governor-general was delegated to investigate the situation, recommended the union of Upper and Lower Canada under responsible government. This came into force in 1841 by the Act of Union, and the two parts of this province became known as Canada West and Canada East.

The territory of what is now British Columbia was also explored during this period. In 1778, Captain James Cook reached the Pacific Northwest and, after exploration, claimed this territory for the British Crown. British settlement of this area began in 1790, after controversy between Spain, which also claimed this area, and Britain was resolved at the Nootka Convention (1790). During the period 1792–94, George Vancouver, who was sent to take possession of this land, explored and mapped

the West coast from Oregon to Alaska. Also, in 1793, Alexander Mackenzie made an overland voyage to the Pacific in a search of a Northwest Passage.

In the 1860s, the economic and political situation—in particular, plans for railroad construction, the need for common defense, and frictions between West and East Canada—necessitated further unification of the country. Federation was established in 1867 by the British North America Act, later renamed the Constitution Act. Originally it included only four provinces: Ontario (Canada West), Quebec (Canada East), Nova Scotia, and New Brunswick. Manitoba (former the Red River Settlement) was included in 1870. British Columbia, Prince Edward Island, and two remaining Prairie provinces, Alberta and Saskatchewan, joined the federation in 1871, 1873 and 1905, respectively. The last province, Newfoundland and Labrador, was admitted significantly later, in 1949. In addition to these provinces, Canada also includes the Yukon Territory, Northwest Territories and Nunavut. Nunavut was officially separated from Northwest Territories by the Nunavut Act of April 1<sup>st</sup>, 1999.

Information in this section is mostly compiled from online encyclopedic sources [Encyclopedia.com](http://Encyclopedia.com) and [Wikipedia.org](http://Wikipedia.org) accessed at the time of writing this document. More information about Canadian history can be found at the web site of the [Museum of Civilization](http://Museum of Civilization).

### ***Overview of Canadian Population and Vital Statistics***

Canadian population and vital statistics data are abundant, originating in the seventeenth century with the early population enumerations and parish registers of New France. This section provides a brief chronological list of events that are relevant to the development of Canadian population statistics. Information presented in this section is compiled mostly from Statistics Canada (1876), Fair (1994), Wargon (2002) and the website of the [Vital Statistics Consul for Canada](http://Vital Statistics Consul for Canada).

1605—The first French settlement (44 settlers) was founded at Port Royal in Acadia.

The first records of population statistics were kept by explorers and missionaries.

1622—Registration of vital events (e.g. baptisms, marriages and burials) was made compulsory by the Catholic Church.

1666—The first Canadian census was taken in the winter of 1665–66 by Jean Talon. It was conducted on a *de jure* basis, covering French settlements in New France; the total enumerated population was 3,215 people. Although the enumerated population was rather small, this undertaking is considered the first census in North America. Results from this census actually influenced demographic politics in New France at that time. An abnormally high sex ratio among the population (2,034 men for 1,181 women) spurred Talon to arrange for young females to immigrate to New France (transportation and settlement expenses, and in some cases a dowry, were assumed by the royal treasury). From 1665 to 1673, 900 "filles du roi" arrived in Quebec, and some of them traveled further to Trois-Rivières and Montréal. Talon also rewarded early marriages and large families, and imposed penalties on bachelors.

1666–1763—Over this period another 36 full and nine partial censuses were conducted in New France. As a result of the Treaty of Paris (1763), New France was ceded to the British Crown, thus ending French census-taking. Starting in 1763, population statistics were not collected as often as before.

1847—The Census and Statistics Act of 1847 made certain provisions for the registration of births and deaths and the collection of decennial censuses. A board for registering vital events was also created.

1851—The first census of the "modern era".

1861—The second census.

1867—The federation was established by the British North America Act (later renamed the Constitution Act). Originally Ontario, Quebec, Nova Scotia, and New Brunswick were included; the other provinces joined later: Manitoba (1870), British Columbia (1871), Prince Edward Island (1873), Alberta and Saskatchewan (1905), Newfoundland and Labrador (1949). Decennial census taking became the responsibility of the federal government.

- 1871—The first census following Confederation. It was much more comprehensive and reliable than the 1851 and 1861 censuses, marking an important milestone in the history of Canadian population statistics.
- 1879—An amendment to the Census Act of May 12<sup>th</sup> 1870 decreed that censuses would be conducted every ten years starting in 1881.
- 1905—A permanent federal Census and Statistics office was established under the Minister of Agriculture. The office was responsible for the 1906 quinquennial and 1911 decennial censuses.
- 1918—The Dominion Bureau of Statistics (Statistics Canada since 1971) was established. The first two dominion-provincial conferences (1918 and 1919) laid the foundation for the national registration of vital events.
- 1920—Vital registration became operational in eight provinces. One of the admission requirements was demonstrated ability to register at least 90% of all vital events. Quebec was admitted to the registration area in 1926 and Newfoundland in 1949. The first annual vital statistics report was published in 1921.
- 1931—Census. The population enumerated in this census and deaths in the years 1930–32 served as the basis for the first national life tables for Canada, prepared by Nathan Keyfitz.
- 1944–1945—A federal family allowance program (1945) created a need for improved registration and verification of birth information. A dominion-provincial conference (1944) called for modernization of the national system of vital statistics and the Vital Statistical Council for Canada and a National Vital Statistical Index were established.
- 1956—The quinquennial census was established on a national basis to be taken every year ending with “6”. Earlier quinquennial censuses were taken predominantly for keeping track of population expansion in the West. In 1906, for example, the quinquennial census was conducted in Manitoba, Alberta and Saskatchewan.

Decennial and quinquennial censuses are currently the primary basis for Canadian population statistics. In addition, Statistics Canada produces intercensal and postcensal population estimates, which are frequently revised and adjusted. Death statistics are compiled by Statistics Canada from death certificates received from provinces, creating the Death Database. These data are edited both at Statistics Canada and in the provincial offices. Data from the Death Database combined with population estimates are used for various tabulations and for computing death rates and life tables in the Human Mortality Database (HMD).

The primary publications where relevant demographic data can be found include: *Annual Demographic Statistics; Births and Deaths; Deaths 2000 (e.g.) Shelf Tables; Health Reports*. A complete catalog of publications is available on the website of [Statistics Canada](#). A large volume of socio-economic and demographic data produced by Statistics Canada is organized in the Canadian Socio-Economic Information Management System (CANSIM) database, which is also accessible via subscribed Canadian universities. Among others, the database includes time series of population, deaths and health status indicators (e.g. life expectancy). Some indicators are provided for a fee and some are free of charge.

### **Sources of Data**

Population data for 1921–1970 were obtained directly from Statistics Canada; these data comprise the final intercensal estimates (denoted ID by Statistics Canada), except for 1961 and 1966, which are census enumerations. Population data for 1971-1995 and for 1996-2012 were also obtained directly from Statistics Canada as they have been recently revised. For years 1971-1995, the revisions are not very extensive and by and large the revised estimates are consistent with the data published in the *Annual Demographic Statistics* publications (Statistics Canada, 2004–2005). For years 1996-2012, the most notable revisions in population estimates are due to the implementation of a new method by Statistics Canada to produce old-age adjustments of census enumerations (see REVISION HISTORY below). Earlier versions of this database, for example, incorporated a) revised intercensal estimates adjusted for net undercount (IR, as denoted by Statistics Canada) for 1971–2000; b) final intercensal estimates (ID) for

2001–2005, and c) either final postcensal estimates (PD) or updated postcensal estimates (PR) for 2006–2010.

Data on births and deaths were obtained directly from Statistics Canada. The data are custom tabulations based on individual death certificate records from the Death Database at Statistics Canada. Before these data could be incorporated into the Human Mortality Database (HMD), several adjustments were required; details are provided below.

### **TERRITORIAL COVERAGE**

Newfoundland and Labrador became a province of Canada in 1949 and statistics for this area is available starting with this year. Therefore, territorial adjustment factors are used to account for this change (for details see the Methods Protocol).

Births and deaths for Yukon Territory, Northwest Territories (NWT) and Nunavut are available for years since 1950 only. In contrast, these territories *are* included in national population estimates for years since 1921. Unfortunately, population estimates by age and sex are not available separately for the Yukon and Northwest Territories, therefore it is not possible to adjust the national population estimates easily (i.e. to subtract out the territories) to be consistent with death counts. However, the numbers are very small: in 1921, Yukon and NWT accounted for only 0.14% of the total population of Canada (12,200 persons out of 8,787,400). The figures for 1949 are of a similar order of magnitude, i.e. 0.18% (24,000 out of 13,447,000). Therefore, the mismatch between the numerator and denominator for computing death rates (i.e. excluding data for Yukon and NWT from deaths but including them in population exposure estimates) would not introduce any significant bias.

### **DEATH COUNT DATA**

#### ***Coverage and Completeness***

Although the vital statistics registration system records all events that occur in Canada, the events pertaining to non-residents who are temporarily in Canada are excluded from tabulations and all publications by Statistics Canada. Deaths of Canadian residents that occur in the United States (which are reported under a reciprocal agreement) *are*

included in the tabulations, but deaths of Canadian residents that occur in countries other than United States are *not* included (Statistics Canada, 1999). Thus, vital statistics cover the *de jure* population, with the exception of deaths (to permanent residents) that occur outside of Canada or the United States. All vital events in official statistical publications were classified by place of occurrence prior to 1944, and since 1944 have been classified by place of reported residence. More information can be found in the description of the Death Database provided by Statistics Canada (Statistics Canada, 2005b).

Because all provinces in Canada are required by law to register vital events, the registration of deaths is considered virtually complete. Nonetheless, some undercount might occur because updating of the Death Database at Statistics Canada is a continuous process. Some death certificates are received after the cut-off date for tabulations (e.g. because of pending police investigation), so they are excluded from annual tabulations. This problem is inherent to the production of death statistics in all countries. In some countries (e.g. Finland), such delayed returns of death certificates or late registrations are published with the death statistics for a later calendar year, making it possible to adjust the earlier published death series. Other countries (e.g. England and Wales) produce two death series, one by year of registration and the other by year of occurrence. Strategies for minimizing the effect of such data processing errors for the Canadian data are currently being investigated.

When the national vital statistics registration system started in 1921, one of the admission requirements was the demonstrated ability to register at least 90% of all vital events. Data for Quebec are available for years since 1921, but this province was not admitted to the registration area until five years later, in 1926; consequently, the official vital statistical publications exclude data for Quebec before this year. The HMD *does* incorporate data for Quebec prior to 1926, but users should be aware that the data for period 1921–1926 might be of inferior quality compared to later years because of concerns regarding the completeness of death registration in Quebec.



### ***Specific Details***

The death counts for 1921–2011 received from Statistics Canada were tabulated by year of death, sex, age and year of birth. To incorporate these data into the HMD, the following adjustments were carried out for missing information:

- Sex unknown: The about 0.06% of deaths where sex was unknown were distributed proportionately based on the distribution of the deaths for which sex was known (within the given age and year of birth range).
- Age unknown but year of birth known: This situation applied to a very small number of deaths which were allocated in proportion to the distribution of the deaths for which age was known (within the given year of birth and sex).
- Age known but year of birth unknown: Again, this situation involved a very small number of deaths, which were allocated in proportion to the distribution by year of birth among the remaining deaths (within the given age and sex).
- Errors in the year of birth: a discrepancy between the year of birth and the age at death was the most common error found in the earliest data. Specific procedures were used to deal with this type of errors (see Bourbeau et al., 2014).
- Both age and year of birth unknown: This problem was the second most common (although it did not involve a lot of cases) and was most pronounced in Ontario 1950–1959 and in Quebec 1975–1978. These cases were distributed proportionately based on the distribution of the deaths for which age and year of birth were both known (for the given sex and province).

Overall, 0.8% of all deaths in Canada presented some sort of problem for which an adjustment was required. The full details of these adjustments can be found in the report by Bourbeau et al. (2014).

Following these adjustments, the death distribution by cohort for any given calendar year and age in each province was checked. Data problems were identified by evaluating Lexis maps of the observed distributions over age and time. In cases where these problems were exceptionally severe (e.g. for Newfoundland, all years before 1982; for Ontario in 1952 and 1999, etc.), the deaths for that age and calendar year (i.e. deaths reported by age but not by birth cohort) were aggregated.

Finally, provincial data were aggregated to produce death counts for Canada as a whole.

## **POPULATION COUNT DATA**

### ***Coverage and Completeness***

Population estimates obtained from census enumerations are subject to undercount errors, which vary from census to census (typically 1–3% for recent censuses). Starting in 1971, Statistics Canada has been correcting the July 1<sup>st</sup> population estimates to adjust for the net undercount in the census. No such adjustments were applied to population estimates for the earlier years.

In addition, since 1971, both population estimates and census counts include non-permanent residents. Given that death counts exclude non-residents, this introduces a bias in the death rate estimates. Work is currently under way to minimize the effects of this bias.

## **BIRTH COUNT DATA**

### ***Coverage and Completeness***

Although the vital registration system records all events that occurred in Canada, the events pertaining to non-residents who are temporarily in Canada are excluded from tabulations and all publications by Statistics Canada. Births to Canadian residents that occur in the United States (which are reported under a reciprocal agreement) *are* included in the tabulations, but births to Canadian residents that occur in countries other than the United States are *not* included (Statistics Canada, 1999). Thus, vital statistics cover the *de jure* population, with the exception of births (to permanent residents) that occur outside of Canada or the United States.

As with deaths, the registration of births is considered virtually complete because it is required by law. Problems such as delayed registration and possible under-registration prior to 1926 described earlier for deaths are also relevant for birth statistics (see "Coverage and Completeness" sub-section under "Death Count Data" for details). More information can be found in the description of the Birth Database provided by Statistics Canada (Statistics Canada, 2005c).

## REVISION HISTORY

### ***Changes with the August 2014 revision:***

**Population counts:** Counts for years 1996-2012 were replaced with revised official estimates, which are based on a method newly implemented by Statistics Canada to produce old-age adjustments of census enumerations. The main impact of this revision is a reduction of population counts at ages 85 and above, with greatest changes among centenarians. This has effects on period values of remaining life expectancies at older ages (e.g., e65, e75, e85) and, to a lesser extent, on period values of life expectancy at birth (e0) for years as early as the mid-1980s. It is expected that Statistics Canada will be releasing a detailed technical paper on its newly implemented method by the end of 2014.

**Deaths:** Death counts for years 2010-2011 were added to the series.

**Births:** Annual birth counts by sex were extended to year 2011.

### ***Changes with the December 2017 revision:***

**Life tables:** All life tables have been recalculated using a modified methods protocol. The revised protocol (Version 6) includes two changes: 1) a more precise way to calculate a0, the mean age at death for children dying during the first year of life and 2) the use of birth-by-month data (where and when available) to more accurately estimate population exposures. These changes have been implemented simultaneously for ALL HMD series/countries. For more details about these changes, see the revised Methods Protocol (at <http://v6.mortality.org/Public/Docs/MethodsProtocol.pdf>), particularly section 7.1 on Period life tables and section 6 and Appendix E, on death rates. The life tables calculated under the prior methods (Version 5) remain available at [v5.mortality.org](http://v5.mortality.org) but will not be further updated in the future.

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## APPENDIX:

### DESCRIPTION OF DATA USED FOR LEXIS DATABASE

#### DEATHS

Period	Type of Data	Age Groups	Comments	RefCode(s) <sup>†</sup>
1921–1949	Annual number of deaths, by sex and single year of age to age 100+	0, 1, ... 100+	Excludes deaths for the territories (i.e., Yukon, Northwest). Includes deaths to the <i>de jure</i> population, with the exception of permanent residents who die outside of Canada or the U.S.	1
1950–2011	Annual number of deaths, by sex, single year of age, and birth cohort (Lexis triangles)	0, 1, ... maximum age attained	Includes deaths to the <i>de jure</i> population, with the exception of permanent residents who die outside of Canada or the U.S.	1, 13, 18, 23, 2001, 2002, 2003, 2004, 2005

† The reference code is used in the raw data files (Input Data) to link data with sources.

#### POPULATION

Period	Type of Data	Age Groups	Comments	RefCode(s)
1961, 1966	Census (June 1 <sup>st</sup> )	0, 1, ... 90+	<i>De jure</i> population	1
1921–1970	Annual July 1 <sup>st</sup> population estimates	0, 1, ... 90+	<i>De jure</i> population	1
1971–2000	Annual July 1 <sup>st</sup> population estimates	0, 1, ... 90+	Adjusted for the net undercount in the censuses; These estimates include temporary residents as well as permanent residents.	14, 22
2001–2010	Annual July 1 <sup>st</sup> population estimates	0, 1, ... 100+	Adjusted for the net undercount in the censuses; These estimates include temporary residents as well as permanent residents.	14, 22

#### BIRTHS BY SEX

**Type of data:** Annual live birth counts by sex

**Period covered:** 1921–2011

**Comments:** Includes births to mothers who are permanent residents (*de jure*), with the exception of those who give birth outside of Canada or the United States.

**RefCodes:** 1, 4, 9, 10, 11, 12, 15, 16, and 21

**BIRTHS BY MONTH**

**Type of data:** Annual live birth counts by month

**Period covered:** 1921–2011

**Comments:** Includes births to mothers who are permanent residents (*de jure*), with the exception of those who gave birth outside of Canada or the United States.

**RefCodes:** 19, 20, and 24