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Technical Guide on Demographic Estimates at Statistics

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Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

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Foreword

For decades, Statistics Canada's Demographic Estimates Program has been making a difference in the lives of Canadians, making significant contributions to the calculation of transfer payments between the Government of Canada and the provinces and territories. In 2024, over \$80 billion was redistributed, based in part on estimates provided by Statistics Canada to Finance Canada, to support policies, programs and initiatives that ensure the well-being of the Canadian population.

The Demographic Estimates Program also supports other laws and programs for Canadians, including the Fair Representation Act, early learning and childcare programs in Canada, and student financial assistance programs.

Also a cornerstone of the national statistical system, demographic estimates also serve as the denominator for many key social and economic indicators produced by Statistics Canada, such as the unemployment rate, various crime and health rates, and gross domestic product per capita.

The Demographic Estimates Program is continuously updated to take into account national and international events that may affect the size and growth of the Canadian population. The Centre for demography updates its data sources and estimation methods on a regular basis, in partnership with the provinces and territories and other key program partners, including expert demographers.

Once every five years, population estimates are matched to the most recent census figures. The Census of Population Program and its coverage studies are therefore fundamental foundations for the estimates, and for maintaining their quality over time.

This document will provide readers with a complete picture on the data and methods used by the Population Estimates Program, and in particular on the estimation of non-permanent residents, a subject which has taken on marked importance since the Covid-19 pandemic.

Introduction

Demographic estimates are the cornerstone of statistical measurement for the population and are put to a wide variety of uses to gain a better understanding of the economic and social situation in Canada. Their importance is highlighted by the statutory requirements for the calculation of revenue transfers and cost-sharing programs between the various levels of government, and their role as population control totals adopted by the Labour Force Survey to derive primary economic indicators such as GDP per capita. Statistics Canada, the national statistical agency responsible for this, and other data, considers the timeliness, accuracy and reliability of demographic estimates to be of the utmost importance.

Every five years, Statistics Canada conducts a national census of population which collects a wide range of demographic data on the Canadian population. The census collects information on citizens, immigrants and non-permanent residents (NPRs) residing in Canada. While some countries have a system of continuous population registration, from which basic demographic data on the state and movement of the population for non-census years can be obtained, this is not the case in Canada.

With its five-year intervals, the census cannot meet the need for timely data required by Statistics Canada's various statistical programs and external data users. To fill this gap, Statistics Canada has developed the Demographic Estimates Program. Various methodological techniques use census data collected by Statistics Canada, along with administrative data provided by other government departments and organizations, to produce estimates of the Canadian population between censuses.¹

As such, demographic estimates are not to be mistaken for the Census counts. They represent an independent set of products of the Demographic Estimates Program derived from Census to establish a complete picture of the Canadian population and what factors are driving it to change over longer and shorter periods of time which the Census cannot capture. In addition to being produced more frequently, population estimates build upon raw Census counts with demographic adjustments and corrections for the Census net undercoverage, including that resulting from incompletely enumerated reserves and settlements. The page *Differences between Statistics Canada's census counts and population estimates*² is available and contains more information on those differences.

In 1987, Statistics Canada published its first manual detailing the methods used for estimating population, *Population Estimation Methods, Canada* (Catalogue no. 91-528-X). The manual represented a direct response to a long-standing policy at Statistics Canada that requires the methods used to produce the agency's statistical information be open to public scrutiny. The manual was updated over time to document conceptual and methodological changes that have been made to the Demographic Estimates Program.

Data quality indicators and analysis of demographic estimates are important for users of these estimates and are helpful to Statistics Canada in fulfilling its role as the national statistical agency responsible for this data. Quality indicators are available inside this guide and within data tables released by Statistics Canada.

This technical guide replaces previous versions of the *Population and Family Estimations Methods at Statistics Canada* (Catalogue no. 91-528-X) manual. It also incorporates methods and concepts previously found in three other publications covering demographic estimates at Statistics Canada: *Quarterly Demographic Estimates* (Catalogue no. 91-002-X), *Annual Demographic Estimates: Canada, Provinces and Territories* (Catalogue no. 91-215-X), and *Annual Demographic Estimates: Subprovincial Areas* (Catalogue no. 91-214-X).

The guide intended to be a compendium of all methods and current procedures used by Statistics Canada to produce and release population and family estimates by combining and updating information from previous manual with that of the separate publications mentioned above.

1. Statistics Canada has also developed a population projections program. Based on extrapolations of past trends, these projections reflect informed hypotheses on Canada's demographic future. For more information about the program, see [Population Projections for Canada, Provinces and Territories](#), Catalogue no. 91-520-X.

2. Statistics Canada. (2023). [Differences between Statistics Canada's census counts and population estimates](#)

Target population

Population counts from the Census form one of the fundamental building blocks necessary to produce population estimates. As such, the target population for demographic estimates is the same as that of the Census. Central to the definition of the target population are concepts of population universe - those that should be counted - and the usual place of residence – the definition of where an enumerated person should be allocated. The next sections contain description of those crucial concepts, based on excerpts from the *Census Technical Report, Census of Population, 2021*.³

Population universe

The definition of target population specifies which persons should be included in the census, but not where these persons should be enumerated. The Canadian census uses the modified *de jure* method of enumeration, under which persons are to be enumerated at their usual place of residence (see next section), even if they are temporarily away on Census Day. Persons away from their usual place of residence and residing elsewhere in Canada must be enumerated at their usual place of residence and are considered present, but temporarily at the other location. Persons who have no usual place of residence are to be enumerated wherever they happen to be on Census Day.

The definition above is extended to demographic estimates produce at Statistics Canada, whereas the usual place of residence obtained from official administrative data sources is used to specify the location or characteristics of demographic events, regardless of temporary change in location.

The Census target population, and consequently the target population for demographic estimates at Statistics Canada, includes the following groups:

- Canadian citizens and landed immigrants (permanent residents) with a usual place of residence in Canada
- Canadian citizens and landed immigrants (permanent residents) who are abroad, either on a military base or attached to a diplomatic mission
- Canadian citizens and landed immigrants (permanent residents) at sea or in port aboard merchant vessels under Canadian registry or Canadian government vessels
- non-permanent residents with a usual place of residence in Canada
 - ▶ who are claiming refugee status (asylum seekers)
 - ▶ who hold a study permit (covering Census Day)
 - ▶ who hold a work permit (covering Census Day)
- and family members living with them.

The Census and demographic estimates population universe does not include foreign residents, but since 1991, it has included non-permanent residents.

Usual place of residence

Under the *de jure* enumeration method used in the Canadian census, the population is enumerated on a “usual place of residence” basis, that is, at the location where a person lives most of the time.⁴ It is used to identify the person as a member of a particular household and, potentially, family (depending on the composition of the household). Most individuals have only one residence, and it is easy to enumerate them at their usual place of residence. In some cases, it is difficult to determine one person’s usual place of residence. Special rules were developed to determine the usual place of residence on Census Day, the details of which can be found in the *Census Technical Report, Census of Population, 2021* mentioned above.

In the case of demographic estimates, various administrative data obtained by Statistics Canada is used to create components of population change. With those, in conjunction with Census counts and several methodological adjustments, an estimated population can be derived for reference dates beyond the latest Census.

3. Statistics Canada. (2023). [Coverage Technical Report, Census of Population, 2021](#)

4. Statistics Canada. (2021). [Dictionary, Census of Population, 2021](#)

The fundamental concept of demographic estimates rests on the availability of that additional administrative data which include, among others, Vital Statistics on births and deaths from provincial and territorial partners, fiscal information from the Canada Revenue Agency, and permanent and temporary immigration records from Immigration, Refugees and Citizenship Canada.

The individual demographic events contained within this administrative data provide the basis needed to estimate how population changes over time through migration between two regions, a family having a child, a foreign student coming to Canada, and more. The location of those events is significant as it enables to appropriately allocate changes in population to the correct province, territory, or subprovincial area. The most recent address information contained within those individual administrative records for a given reference date is used to represent the usual place of residence associated with each demographic event.

Gender and sex at birth

The demographic estimates now incorporate the concept of gender, which was first introduced in the 2021 Census of Population.⁵

Demographic estimates are published by gender rather than by sex at birth, in accordance with the Treasury Board of Canada Secretariat's "Policy Direction to Modernize the Government of Canada's Sex and Gender Information Practices" (2018).⁶ This directive states that the gender variable is expected to be used by default in most social statistics programs at Statistics Canada.⁷

Gender refers to an individual's personal and social identity as a man, woman or non-binary person (a person who is not exclusively a man or a woman). Gender includes the following concepts:

- gender identity, which refers to the gender that a person feels internally and individually;
- gender expression, which refers to the way a person presents their gender, regardless of their gender identity, through body language, aesthetic choices or accessories (e.g., clothes, hairstyle and makeup), which may have traditionally been associated with a specific gender.

A person's gender may differ from their sex at birth, and from what is indicated on their current identification or legal documents such as their birth certificate, passport or driver's license. A person's gender may change over time. Some people may not identify with a specific gender.

Demographic estimates are available for the gender category "Men+," which includes men (and/or boys), as well as some non-binary persons, and for the gender category "Women+," which includes women (and/or girls), as well as some non-binary persons.

For the sake of uniformity, all data products from the Demographic Estimates Program now adopt the term "gender" for all years and periods. Prior to 2021, the demographic estimates are based on the concept of sex at birth. Although gender and sex at birth are two different concepts, this change does not cause a significant break in the trend because the two concepts produce very similar distributions.

Population estimates by age and sex at birth continue to be available upon request. These estimates can be used where information on sex at birth is needed, for example, for measuring some demographic and health indicators.

Levels of estimates

There are two categories of population estimates produced by Statistics Canada: postcensal and intercensal. The first category, postcensal estimates, are produced by using data from the most recent census (adjusted for census net undercoverage (CNU), including incompletely enumerated reserves and settlements) and estimates of the components of population change since that last census. These components include births, deaths, immigrants, non-permanent residents, emigrants, returning emigrants, and interprovincial migrants – plus intraprovincial migrants for subprovincial demographic estimates.

5. Statistics Canada. (2022). [Filling the gaps: Information on gender in the 2021 Census](#)

6. Treasury Board of Canada Secretariat. (2018). [Modernizing the Government of Canada's Sex and Gender Information Practices: summary report](#)

7. Statistics Canada. (2021). [Gender of Person Reference Guide](#)

Due to data timeliness and completeness, components mentioned above themselves can be updated over time as more complete data becomes available. This is represented by data being assigned a “level of estimates”, which differs slightly between components of population change and population estimates themselves. Each component will first be released as “preliminary” (noted “P”) level, with following releases moving to “updated” (noted “R”) or “final” (noted “D”) when new data is incorporated in following production.

Postcensal population estimates will be assigned a level based on that of the components used to derive it. Postcensal population estimates for any given reference date are always of level “preliminary postcensal” estimates (noted “PP”) when they are first released. Any change to the estimates resulting from one or more updated component of population change during a subsequent production would result in “updated postcensal” estimates (noted “PR”). Only when all individual components are considered “final” can the population be considered “final postcensal” estimates (noted “PD”).

For the provinces and territories, preliminary estimates are typically available within three to four months after the reference date (seven to eight months for subprovincial estimates), while updated estimates are usually available within one year (one and a half year for subprovincial estimates). Final estimates are the most accurate postcensal estimates available and typically take two to three years to complete. The production of three types of estimates is the strategy that best satisfies the commitment of Statistics Canada to balance the timeliness and accuracy of data quality.

Intercensal estimates are produced every five years and reconcile previous postcensal estimates with the latest census counts adjusted for census net undercoverage. The reconciliation with postcensal estimates leads intercensal estimates to need an additional component of population change, residual deviation. Those estimates are generated as soon as census population counts and census net undercoverage become available, a process which typically takes two years after census data collection to complete. Postcensal estimates are always assigned the level of “final intercensal” (noted “ID”) as they do not undergo further updates.

Disseminated estimation products

Demographic estimates are disseminated at six geographic levels: provinces and territories, census divisions, census metropolitan areas and census agglomerations, economic regions, health regions and peer groups, and census subdivisions. Demographic estimates at custom-defined subprovincial levels are possible and can be produced through special cost-recovery tabulations.

According to the level of geography and type of estimate, different demographic characteristics of the population (including age and gender) are produced. Table 1 shows the level of detail and the reference period for which demographic estimates are disseminated.

Table 1.1
Availability of population estimates and components of population change

Geography	Characteristics	Type of estimate ¹	Frequency
Canada, provinces and territories	Total population and components of population change	Population: PP, PR, PD, ID Components : P, R, D	Quarterly Annual
	Population and components of population change by age and gender	Population: PP, PR, PD, ID Components : P, R, D	Annual
	Census families by size and structure and census families by structure and age group	Census families: PP, PR, PD, ID	Annual
	Private households by size and age	Private households: PP, PR, PD, ID	Annual
	Economic entities by size and age	Economic entities: PP, PR, PD, ID	Annual
Census divisions, census metropolitan areas and census agglomerations, economic regions	Population and components of population change by age and gender	Population: PP, PR, PD, ID Components : P, R, D	Annual
Health regions and peer groups	Population by age and gender	Population: PP, PR, PD, ID	Annual
Census subdivisions	Total population and population by age and gender	Population: PP, PR, PD, ID	Annual

1. PP: preliminary postcensal
 PR: updated postcensal
 PD: final postcensal
 ID: final intercensal
 P: preliminary
 R: updated
 D: final

Users of demographic estimates

At Statistics Canada, demographic information is used to calibrate sampling weights of many social and household surveys and is a fundamental part of the analytical framework of most statistical programs. Estimates of Canada's population have other wide-ranging applications in the areas of planning and program evaluation in both the public and private sectors. The calculation of revenue transfers under various federal statutory programs, for example, as well as cost-sharing agreements between federal, provincial, territorial and municipal governments are highly dependent on demographic data.

Statistics Canada is also under statutory obligation to provide the federal government with annual population figures as well as various economic indicators (e.g., gross domestic product) that have been certified by the Chief Statistician of Canada. These figures are used to determine the amounts payable under various federal-provincial fiscal arrangements such as the Equalization and Territorial Formula Financing (TFF), the Canada Health Transfer (CHT) and the Canada Social Transfer (CST), according to a per capita funding formula. The federal government distributes billions of dollars annually in federal transfers to provinces and territories using population estimates.⁸ Since 2011, the estimates have also been used in the provincial readjustment of federal electoral boundaries as described in the *Fair Representation Act*.⁹

The CHT and CST are federal transfers that support specific policy areas, such as health care, postsecondary education, social assistance and social services, early childhood development, and childcare.

The equalization and TFF programs provide unconditional transfers to the provinces and territories. Equalization allows less prosperous provincial governments to provide their residents with public services that are reasonably comparable to those in other provinces, at reasonably comparable levels of taxation. TFF provides territorial governments with funding to support public services to account for the higher cost of providing programs and services in the Canadian North.

Population is a key variable of the distribution formula used by the federal government to determine its annual expenditures. As billions of dollars depend directly upon these allocation formulas, accurate and up-to-date estimates are extremely important.

8. [Federal transfers to provinces and territories](#). Department of Finance Canada.

9. [Fair Representation Act](#). S.C. 2011, c. 26. (2011).

The Government of Canada relies on population data to make informed decisions on some of its most fundamental policies. For example, up-to-date information on the evolving demographic situation in Canada proves useful for Cabinet in its decisions relating to immigration policy. These data also contribute to increasing the cost-effectiveness of public policy expenditures.

Provincial and municipal governments also use demographic estimates to plan social programs and establish cost-sharing agreements based on the per capita spending formula. Among the public service users of Statistics Canada's estimates are education and public health planners, and public administrators responsible for policing, criminal justice, municipal administration, and waste and environmental management.

Demographic estimates are fundamental in the calculation of social and economic indicators, in particular birth rates, death rates, school enrolment rates, unemployment rates, and life expectancy. Population serves directly as the denominator in many of these indicators, with Statistics Canada directly providing population control totals used by the Labour Force Survey for its measures of economic indicators for example. Survey researchers, whether at Statistics Canada, in academia, or in private polling agencies, must use up-to-date figures in survey planning and in the calculation of sampling weights.

The private sector also uses demographic estimates for business planning, marketing research and investments. The estimates also help companies properly segment and target their markets and make sound investment decisions.

Overview of this guide

The *Population estimation methods – Canada, provinces and territories* chapter presents the overall methods used to produce population estimates for Canada, provinces and territories, and focuses on describing the various types of estimation - postcensal and intercensal estimates. The *Population estimation methods – Subprovincial regions* chapter covers various methods used to produce population estimates for subprovincial areas.

The individual chapters that follow include discussions on data sources, concepts and methodology for each of the components of population change. Each chapter describes how total estimates are produced, as well as estimates by age and gender, and subprovincial estimates for the component. This should give the reader a clearer picture of the limits of each method.

Topics covered include calculation of the base population, and the methods used for estimating births and deaths, the components of international migration (immigrants, non-permanent residents, emigrants and returning emigrants), interprovincial migration, and intraprovincial migration for subprovincial areas.

Later chapters describe the methods for estimating census families, economic entities and households, and the methods used to estimate and ensure data quality of demographic estimates over time. A glossary of the main terms used, and acknowledgements, are also available at the end of the document.

Chapter 1

Population estimation methods, Canada, provinces and territories

This chapter describes the methods used by Statistics Canada to calculate postcensal and intercensal demographic estimates for the total population and for the population by age and gender for provinces and territories. For each type of estimate, detailed calculations and their data sources are presented.

Definitions and concepts

Postcensal population estimates are produced using data from the most recent census (adjusted for census net undercoverage (CNU¹⁰), including incompletely enumerated reserves and settlements) and estimates of the components of demographic growth since that census. The data is adjusted from Census Day to the following July 1 using the components of demographic growth between Census Day and June 30 of that census year.

Intercensal estimates are estimates of population for reference dates found between two censuses. They are produced following each census to reconcile previous postcensal estimates with the new census counts adjusted for CNU (including incompletely enumerated reserves and settlements), thus ensuring the internal consistency of the estimation system.

The production of intercensal estimates involves two main steps:

1. The calculation of the error of closure;
2. The linear distribution of the error of closure according to the number of days between the two censuses.

The error of closure is defined as the difference between the postcensal population estimates on Census Day and the population enumerated in that census (after adjustment for CNU and inclusion of incompletely enumerated reserves and settlements). If the coverage studies that follow each enumeration are unbiased, the adjusted intercensal figures are considered exact.

Postcensal population estimates

The component method used to produce postcensal estimates is a population accounting system where modifications are made to the current census population adjusted for CNU, or the most recent estimate, by adding and subtracting the components of demographic growth between July 1 and the reference date of the estimate. For provinces and territories, the factors of demographic growth and their components are:

Natural increase

- Births
- Deaths

International migration

- Immigrants
- Emigrants
- Returning emigrants
- Non-permanent residents
 - ▶ Inflows
 - ▶ Outflows

Interprovincial migration

- In-migrants
- Out-migrants

10. Unless otherwise specified, the CNU always includes incompletely enumerated reserves and settlements.

Components of population change can be divided into two groups: those components for which administrative data with a high degree of completeness are typically available, such as births, deaths, immigrants, and non-permanent residents, and those that require more significant modeling, such as interprovincial migration, emigrants, and returning emigrants. Nevertheless, all components require some amount of modeling, cleaning and imputation of input data to derive figures suited to produce demographic estimates. Often, the administrative data used in calculating estimates were not produced for statistical purposes and are the responsibility of other federal departments such as Immigration, Refugees and Citizenship Canada or the Canada Revenue Agency.

The two components of natural increase, i.e. births and deaths, have similar methodological approach when it comes to estimation. Provincial and territorial Vital Statistics Acts (or equivalent legislation) render compulsory the registration of all live births and deaths within each province and territory. Vital statistics universe includes births and deaths of all Canadians, immigrants and non-permanent residents (NPR) and exclude foreign residents.

International migration represents the movement of population (a change in the usual place of residence) between Canada and a foreign country.

Within the Demographic Estimates Program, international migration consists of four components: immigrants, emigrants, returning emigrants, and non-permanent residents. International migration flows can be categorized as either permanent or temporary. Permanent flows refer to persons arriving in Canada for permanent residence (immigrants), Canadian citizens or immigrants returning to Canada after having previously emigrated from Canada (returning emigrants), and Canadian citizens or immigrants leaving Canada to establish a permanent residence in another country (emigrants). Temporary flows refer to foreigners arriving for temporary stay in Canada, which can end when they leave the country or if they become a permanent immigrant.

Net non-permanent residents represent the variation in the number of non-permanent residents between two dates and is the difference between inflows of non-permanent residents and outflows of non-permanent residents. Different methodological approaches are used for each component of international migration; one for immigrants, another one for non-permanent residents and a model-based approach for the emigrants and returning emigrants.

The last factor of demographic growth that is discussed is the interprovincial migration. While this factor does not affect the total population of Canada, it does affect provincial and territorial populations.

Estimates of population are first produced for each province and territory and are then summed to obtain an estimate of the population of Canada.

A chapter is dedicated to each component in this guide. Each chapter describes how different components are derived, including their data sources, models and revisions they undergo over time from preliminary to definitive estimates.

Total postcensal population estimates

The component method used in estimating total provincial and territorial populations is expressed in Equation 1.1. The same calculation is applied to obtain preliminary postcensal, updated postcensal and definitive postcensal population estimates.

Equation 1.1:

$$P_{(t+i)} = P_t + B_{(t,t+i)} - D_{(t,t+i)} + I_{(t,t+i)} - E_{(t,t+i)} + RE_{(t,t+i)} + \Delta NPR_{(t,t+i)} + \Delta Inter_{(t,t+i)}$$

Where, for each province and territory:

$(t, t + i)$	=	interval between times t and t+i;
$P_{(t+i)}$	=	estimate of population at time t+i;
P_t	=	base population at time t;
B	=	number of births;
D	=	number of deaths;

- I = number of immigrants;
- E = number of emigrants;
- RE = number of returning emigrants;
- ΔNPR = net non-permanent residents;
- $\Delta Inter$ = net interprovincial migrants.

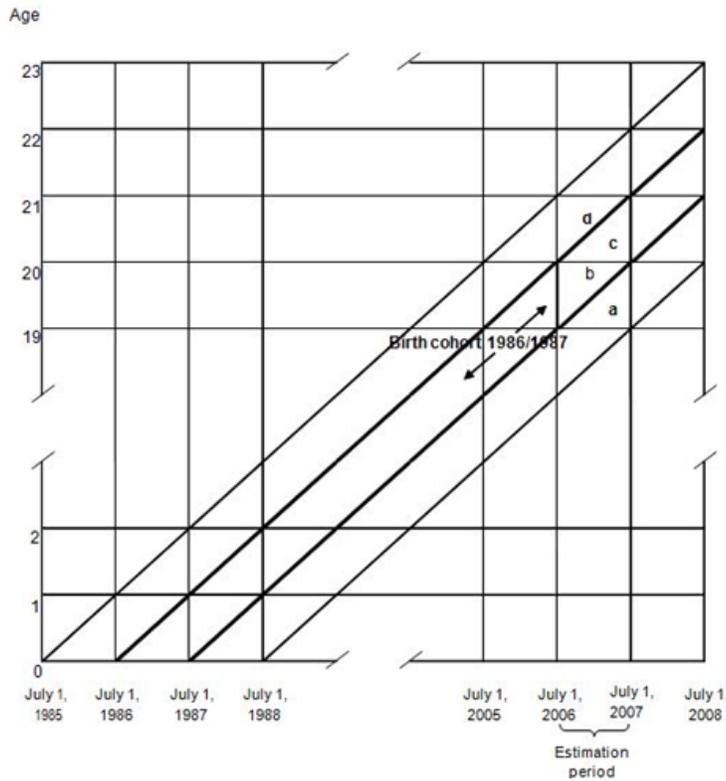
Postcensal population estimates by age and gender

Postcensal estimates of population by age and gender are produced using the cohort-component approach. This approach requires a slight modification of the component approach described above for total population estimates, but the overall principle remains the same.

To calculate postcensal population estimates by age and gender, birth cohorts (those persons born during the same year) for both men+ and women+ are used. The cohort-component approach factors in the aging of the cohorts over time. For example, persons aged 19 one year will be 20 years old the following year. The data required for the cohort-component method is the same as for total population, but with specific age and gender cohort details. This includes births, deaths, immigrants, emigrants, returning emigrants, non-permanent residents and interprovincial migrants.

Demographers use a tool called a Lexis diagram (Figure 1) to aid in the linking of events to specific cohorts. Time is located on the horizontal axis, while the vertical axis represents age. Specific cohorts are identified by the diagonals (lifelines) that cross the diagram. Using the cohort-component approach, demographic events are organized to follow these lifelines.

Figure 1
Lexis diagram



Source: Statistics Canada, Centre for Demography.

Take, for example, those aged 19 as of July 1, 2006, who belong to the cohort born between July 1, 1986, and June 30, 1987 (inclusive). The demographic events experienced by this cohort during the estimation period are represented by triangles b and c.

Under the cohort-component method, the equations for estimating annual postcensal population by single years of age and gender at the provincial and territorial level are as follows:

For each gender, by province and territory:

At age 0:

Equation 1.2:

$$P_{(t+1)}^0 = B_{(t,t+1)} - D_{(t,t+1)}^{-1} + I_{(t,t+1)}^{-1} - E_{(t,t+1)}^{-1} + RE_{(t,t+1)}^{-1} + \Delta NPR_{(t,t+1)}^{-1} + \Delta Inter_{(t,t+1)}^{-1}$$

For ages 1 to 119:

Equation 1.3:

$$P_{(t+1)}^{(a+1)} = P_t^a - D_{(t,t+1)}^a + I_{(t,t+1)}^a - E_{(t,t+1)}^a + RE_{(t,t+1)}^a + \Delta NPR_{(t,t+1)}^a + \Delta Inter_{(t,t+1)}^a$$

For age 120 years and older:

Equation 1.4:

$$P_{(t+1)}^{120+} = P_t^{119+} - D_{(t,t+1)}^{119+} + I_{(t,t+1)}^{119+} - E_{(t,t+1)}^{119+} + RE_{(t,t+1)}^{119+} + \Delta NPR_{(t,t+1)}^{119+} + \Delta Inter_{(t,t+1)}^{119+}$$

Where:

$(t, t+1)$	= interval between times t and t+1;
a	= age;
$P_{(t+1)}$	= estimate of the population at time t+1;
P_t	= base population at time t;
B	= number of births;
D	= number of deaths;
I	= number of immigrants;
E	= number of emigrants;
RE	= number of returning emigrants;
ΔNPR	= net non-permanent residents;
$\Delta Inter$	= net interprovincial migrants.

In the equations above, an age of -1 refers to the cohort who had a demographic event at age 0 during the interval (t, t+1) but who was not born at the beginning of the interval. The same calculations are used to obtain preliminary postcensal, updated postcensal and definitive postcensal population estimates by age and gender.

Intercensal population estimates

Intercensal population estimates serve to reconcile previous postcensal estimates with the new census counts adjusted for CNU (including incompletely enumerated reserves and settlements). To do this, the error of closure

between postcensal estimates and adjusted censal population is calculated and distributed linearly across the period between two consecutive censuses.

More specifically, the error of closure is calculated as:

Equation 1.5:

$$\varepsilon = P - \mathbf{P}$$

Where:

ε = error of closure,

P = postcensal population estimate,

\mathbf{P} = census population counts after adjustment for CNU.

The error of closure comes from two sources: measurement errors in any of the components of demographic growth over the intercensal period and errors from the measurement of census coverage for the current and previous censuses.

The error of closure can be calculated for any disaggregated group, or for any summation of such disaggregation up to and including the total population. The disaggregation of the CNU is modeled as the sample size is not sufficient to give reliable disaggregated estimates.

A chapter of this methodological guide focuses on indicators of the quality of estimates, including error of closure.

Total intercensal population estimates

To produce intercensal estimates, it is assumed that the error of closure is a linear function of the time elapsed since the previous census. The production of intercensal estimates of total population involves two steps: the calculation of the error of closure (ε) as in Equation 1.5, and the distribution of this error uniformly over the intercensal period.

Once error of closure has been calculated, intercensal population estimates for the five years between the two censuses are produced. To produce an intercensal estimate of the population at time t we need the following information:

1. The Census dates (α and β).
2. The date of the intercensal estimate to be produced (t).
3. The error of closure at the end of the period (ε_β).
4. The postcensal estimate of the population at time t (P_t).

Intercensal estimates at time t (IP_t) are obtained using the following formula:

Equation 1.6:

$$IP_t = P_t - \left(\frac{t - \alpha}{\beta - \alpha} \right) \varepsilon_\beta$$

Intercensal estimates are then rounded to the nearest integer and the residual is calculated for each month in the intercensal period. This residual, also known as residual deviation, is an added component of population change that is used to balance the adjustments made to the postcensal population P for the error of closure. With it, populations derived using the existing estimated components of population change remains coherent. It is calculated as follows:

For the month containing the date of the previous census of the intercensal period under consideration ($m(\alpha)$), for example, May 2016):

Equation 1.7:

$$Resid_{m(\alpha)} = P_{m(\alpha)+1} - IP_{m(\alpha)+1}$$

For the months $m(t)$ between the two censuses $m(\alpha)$ and $m(\beta)$ (for example, June 2016 to April 2021):

Equation 1.8:

$$Resid_{m(t)} = P_{m(t)+1} - IP_{m(t)+1} - \sum_{k=m(\alpha)}^{m(t)-1} Resid_k$$

For the month containing the date of the most recent census of the intercensal period under consideration ($m(\beta)$), for example, May 2021):

Equation 1.9:

$$Resid_{m(\beta)} = P_{\beta} - CE_{\beta} - \sum_{k=m(\alpha)}^{m(\beta)-1} Resid_k$$

Where:

CE = censal estimates.

The sum of all residuals equals the error of closure.

Because calculated intercensal estimates will not equal postcensal estimates as derived from the addition of component of population growth, a difference in the component formula will remain. This difference is represented by the component of residual deviation, which leads to an additional term of *Resid* in the formula to calculate total intercensal population estimates. The formula becomes:

Equation 1.10:

$$P_{(t+i)} = P_t + B_{(t,t+i)} - D_{(t,t+i)} + I_{(t,t+i)} - E_{(t,t+i)} + RE_{(t,t+i)} + \Delta NPR_{(t,t+i)} + \Delta Inter_{(t,t+i)} + Resid_{(t,t+i)}$$

Where, for each province and territory:

$(t, t+i)$	=	interval between times t and $t+i$;
$P_{(t+i)}$	=	estimate of population at time $t+i$;
P_t	=	base population at time t ;
B	=	number of births;
D	=	number of deaths;
I	=	number of immigrants;
E	=	number of emigrants;
RE	=	number of returning emigrants;
ΔNPR	=	net non-permanent residents;
$\Delta Inter$	=	net interprovincial migrants;
$\Delta Resid$	=	Residual deviation.

Intercensal population estimates by age and gender

The error of closure for each gender and single year of age is the difference between the population estimates and the census counts (after adjustment for CNU¹¹). The method is the same as for the total population. The production of the intercensal estimates by age and gender involves three steps:

1. the calculation of the error of closure by age and gender;
2. the distribution of this error;
3. a final adjustment to ensure consistency with total population estimates calculated independently.

Except for ages between 0 and 4 years, and for the open group of 120 years and older, the error of closure associated with each gender and single year of age is distributed linearly, as a function of the time elapsed since the previous census. Distributing the error of closure between censuses following specific cohorts generates intercensal estimates.

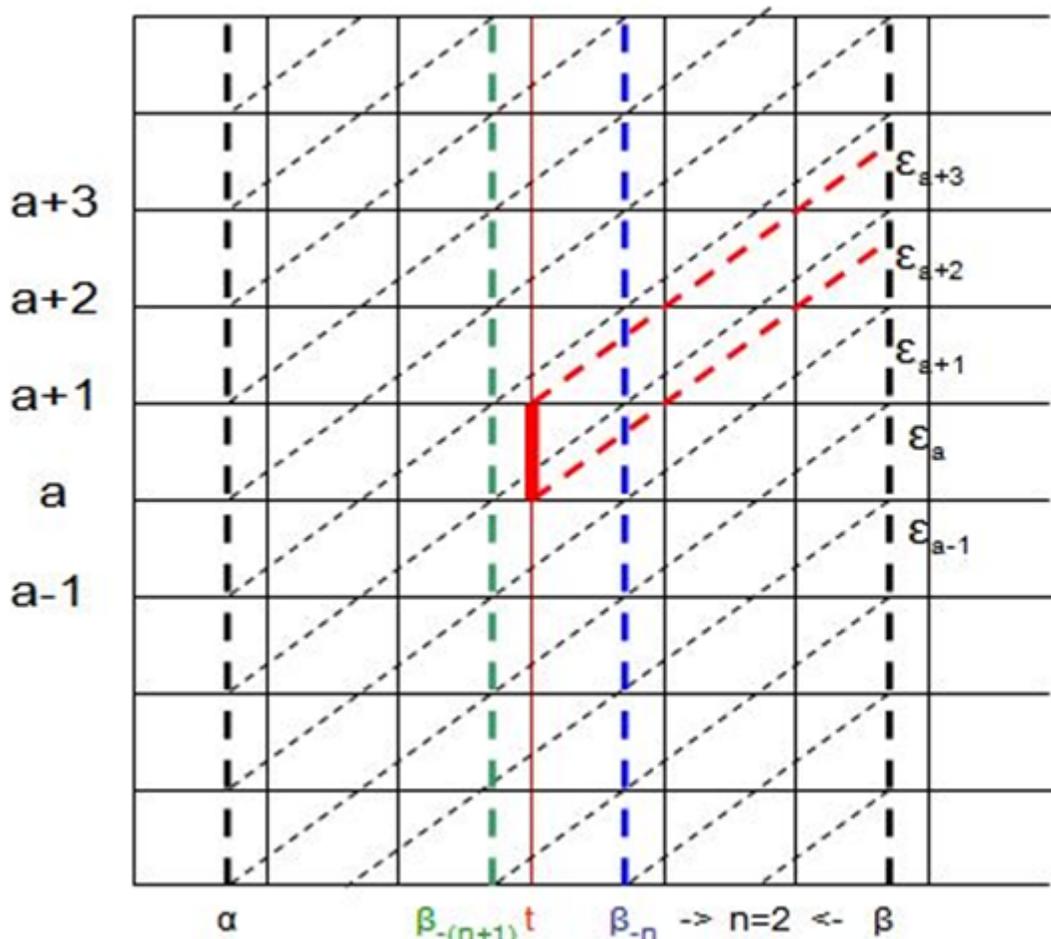
To calculate an intercensal estimate at time t for a given province (or territory) p , a particular age a and a gender g , we must first define the following:

1. The dates of the two censuses (α and β).
2. The date of the estimate (t).
3. The error of closure by province, age and gender ($\mathcal{E}_{p,a,g}$).
4. The postcensal population estimate at time t for province p , age a and gender g ($P_t(p, a, g)$).
5. The variable n which denotes the number of whole years that separates t and β . For example, if $t =$ July 1, 2018, and $\beta =$ May 11, 2021, then $n = 2$.

The following Lexis diagram (Figure 2) is used to illustrate a general example of intercensal estimate by age and gender.

11. The CNU by age and gender was produced using a model-based methodology as reliable estimates were not available due to insufficient sample size.

Figure 2
Lexis diagram showing intercensal estimation



Source: Statistics Canada, Centre for Demography.

The intercensal population estimate at time t for province or territory p , for age a and gender g is calculated differently based on the date and age:

A. If $t_a > \alpha$, meaning that the age cohort or part of the cohort was born after the previous census) the following formula is used:

Equation 1.11:

$$IP'_i(p, a, g) = P_i(p, a, g) - \left[\left(\frac{t - \beta_{-(n+1)}}{\beta_{-n} - \beta_{-(n+1)}} \right) f_{t, a, a+n} \varepsilon(p, a+n, g) + \left(\frac{\beta_{-n} - t}{\beta_{-n} - \beta_{-(n+1)}} \right) f_{t, a, a+n+1} \varepsilon(p, a+n+1, g) \right]$$

Where:

$f_{t, a, x}$ = is the fraction of the age cohort at time t aged x (which is either $a+n$ or $a+n+1$ at the time of the current census β), this is the portion of time between a and t in relation to the whole intercensal period.

To calculate this fraction, the variables below are defined as:

- p = date at the start of births for this cohort;
- q = date at the end of births for this cohort.

These are assigned as follows:

If $x = a + n$, then $p = \beta_{-(a+n+1)}$ and $q = t_{-a}$.

If $x = a + n + 1$, then $p = t_{-(a+1)}$ and $q = \beta_{-(a+n+1)}$.

Once p and q are known, $f_{t,a,x}$ is as follows:

Equation 1.12:

$$f_{t,a,x} = \frac{A_{p,q}(\alpha, t)}{A_{p,q}(\alpha, \beta)}$$

Where:

$A_{p,q}(i, j)$ = area between time i and j of the cohort where the births have occurred between p and q. It is noteworthy that this area is relative to the size of the cohort (q-p). These results remain valid given that the size of the cohort cancels out in the calculation of $f_{t,a,x}$.

To calculate $A_{p,q}(i, j)$, the following variables are derived:

- $i' = \max(i, p)$
- $j' = \max(\min(j, q), i)$
- $i'' = \max(i, q)$
- $j'' = \max(j, q)$

The area is then obtained using the following formula:

Equation 1.13:

$$A_{(p,q)}(i, j) = \left(\frac{(j' - i')(i' - p) + \frac{(j' - i')^2}{2}}{q - p} \right) + (j'' - i'')$$

In the case where $p=q$, $f_{t,a,x} = 1$. This is arbitrary and will not affect the outcome since the condition to have $p=q$ implies that this term of the equation is nil.

B. If $t_{-a} \leq \alpha$ and $a \leq \text{agemax}-n-2$, meaning no births in the intercensal period are involved and the last age cohort is still bound by the current census (β):

In this case the general formula described previously can still be used. In fact, it can be shown that if $t_{-a} \leq \alpha$ and $a \leq \text{agemax}-n-2$, the formula reduces to the following expression:

Equation 1.14:

$$IP'_i(p, a, g) = P_i(p, a, g) - \left[\frac{t - \alpha}{\beta - \alpha} \right] \left[\left(\frac{t - \beta_{-(n+1)}}{\beta_{-n} - \beta_{-(n+1)}} \right) \varepsilon(p, a + n, g) + \left(\frac{\beta_{-n} - t}{\beta_{-n} - \beta_{-(n+1)}} \right) \varepsilon(p, a + n + 1, g) \right]$$

C. If $a = \text{agemax} - n - 1$, the age cohorts that will reach the last bound age cohort during the intercensal period:

Once the age cohort reaches $\text{agemax} - n - 1$, cohorts that are as old or older than the maximum age that is released in the estimates (agemax) at the time of the recent census (β) must be considered. At $\text{agemax} - n - 1$, the error of closure is used for $\text{agemax} - 1$ and agemax .

Equation 1.15:

$$IP'_i(p, a, g) = P_i(p, a, g) - \left[\frac{t - \alpha}{\beta - \alpha} \right] \left[\left(\frac{t - \beta_{-(n+1)}}{\beta_{-n} - \beta_{-(n+1)}} \right) \varepsilon(p, a + n, g) + \frac{\left(\frac{\beta_{-n} - t}{\beta_{-n} - \beta_{-(n+1)}} \right) P_i(p, a, g)}{\left(\frac{\beta_{-n} - t}{\beta_{-n} - \beta_{-(n+1)}} \right) P_i(p, a, g) + \sum_{i=a+1}^{\text{agemax}} P_i(p, i, g)} \varepsilon(p, \text{agemax}, g) \right]$$

In the case where $\sum_{i=a}^{\text{agemax}} P_i(p, i, g) = 0$, a uniform distribution is assumed, and the equation becomes:

Equation 1.16:

$$IP'_i(p, a, g) = P_i(p, a, g) - \left[\frac{t - \alpha}{\beta - \alpha} \right] \left[\left(\frac{t - \beta_{-(n+1)}}{\beta_{-n} - \beta_{-(n+1)}} \right) \varepsilon(p, a + n, g) + \frac{\left(\frac{\beta_{-n} - t}{\beta_{-n} - \beta_{-(n+1)}} \right)}{\left(\frac{\beta_{-n} - t}{\beta_{-n} - \beta_{-(n+1)}} \right) + n + 1} \varepsilon(p, \text{agemax}, g) \right]$$

D. If $a \geq \text{agemax} - n$, these are the remaining cohorts in the unbound category:

In this last case, the age cohorts are at agemax or older at time β .

Equation 1.17:

$$IP'_i(p, a, g) = P_i(p, a, g) - \left[\frac{t - \alpha}{\beta - \alpha} \right] \left[\frac{P_i(p, a, g)}{\left(\frac{\beta_{-n} - t}{\beta_{-n} - \beta_{-(n+1)}} \right) P_i(p, \text{agemax} - n - 1, g) + \sum_{i=\text{agemax} - n}^{\text{agemax}} P_i(p, i, g)} \right] \varepsilon(p, \text{agemax}, g)$$

In the case where, $\sum_{i=\text{agemax} - n}^{\text{agemax}} P_i(p, i, g) = 0$, a uniform distribution is used, and the equation reduces to:

Equation 1.18:

$$IP'_i(p, a, g) = P_i(p, a, g) - \left[\frac{t - \alpha}{\beta - \alpha} \right] \left(\frac{1}{\left(\frac{\beta_{-n} - t}{\beta_{-n} - \beta_{-(n+1)}} \right) + n + 1} \right) \varepsilon(p, agemax, g)$$

Adjustment of the intercensal estimate to maintain coherence with the total intercensal population estimated by province

Since the error of closure is estimated by cohorts, the intercensal estimates by age and gender will not exactly match the total by province as measured in the first part of this chapter. A final adjustment is done to ensure that both estimates are consistent.

Equation 1.19:

$$IP_i(p, a, g) = \left(\frac{IP_t^{total}(p)}{\sum_{i,j} IP'_i(p, i, j)} \right) IP'_i(p, a, g)$$

Where $IP_t^{total}(p)$ is the intercensal population estimate measured for province p using Equation 1.6 to Equation 1.9 at time t.

The special case where the intercensal population estimates become negative

It can happen, although rarely, that for certain age and gender cohorts for certain provinces or territories that have very low counts, the methodology described above results in negative population counts. In these cases, the counts will be set to zero and the difference will be redistributed proportionately in all the other cohorts. The estimates are then rounded to the nearest integer.

As with total intercensal population estimates, the cohort-component formula used for postcensal estimates by age and gender will be modified for intercensal estimates by age and gender. This is to account for the difference between postcensal estimates derived from components of population change, and calculated intercensal estimates. The difference appears under the residual deviation, noted *Resid* in the formula for intercensal population estimates by age and gender, calculated for each gender as:

Equation 1.20:

$$Resid_{(t,t+1)}^a = P_{(t+1)}^a - IP_{(t+1)}^a$$

Where:

- $P_{(t+1)}^a$ = Final postcensal population estimate at time (t+1) for age a
- $IP_{(t+1)}^a$ = Final intercensal population estimate at time (t+1) for age a

For each gender, by province and territory, the cohort-component population formula becomes:

At age 0:

Equation 1.21:

$$P_{(t+1)}^0 = B_{(t,t+1)} - D_{(t,t+1)}^{-1} + I_{(t,t+1)}^{-1} - E_{(t,t+1)}^{-1} + RE_{(t,t+1)}^{-1} + \Delta NPR_{(t,t+1)}^{-1} + \Delta Inter_{(t,t+1)}^{-1} + Resid_{(t,t+1)}^{-1}$$

For ages 1 to 119:

Equation 1.22:

$$P_{(t+1)}^{(a+1)} = P_t^a - D_{(t,t+1)}^a + I_{(t,t+1)}^a - E_{(t,t+1)}^a + RE_{(t,t+1)}^a + \Delta NPR_{(t,t+1)}^a + \Delta Inter_{(t,t+1)}^a + Resid_{(t,t+1)}^a$$

For age 120 years and older:

Equation 1.23:

$$P_{(t+1)}^{120+} = P_t^{119+} - D_{(t,t+1)}^{119+} + I_{(t,t+1)}^{119+} - E_{(t,t+1)}^{119+} + RE_{(t,t+1)}^{119+} + \Delta NPR_{(t,t+1)}^{119+} + \Delta Inter_{(t,t+1)}^{119+} + Resid_{(t,t+1)}^{119+}$$

Where:

- $(t, t + 1)$ = interval between times t and t+1;
- a = age;
- $P_{(t+1)}$ = estimate of the population at time t+1;
- P_t = base population at time t;
- B = number of births;
- D = number of deaths;
- I = number of immigrants;
- E = number of emigrants;
- RE = number of returning emigrants;
- ΔNPR = net non-permanent residents;
- $\Delta Inter$ = net interprovincial migrants;
- $Resid$ = residual deviation.

Population estimates by age and sex at birth

In addition to estimates by age and gender, population estimates by age and sex at birth are produced on an annual basis and are also available upon request. They are calculated using the annual population estimates by age and gender, to which ratios derived from the 2021 Census data are applied to obtain numbers for men and women by single year of age. The two series of estimates must be treated separately and are not designed to be cross-tabulated. Therefore, users should use caution when comparing the estimates from the two series. It is not possible to obtain estimates of transgender, cisgender, or non-binary persons by combining the information from these two series of estimates.

Population estimates by age and sex at birth are assigned the same estimation level as that of the population estimates by age and gender for the same reference period to which the ratios are applied.

Chapter 2

Population estimation methods, subprovincial areas

In addition to estimates at the national, provincial and territorial levels, population estimates are produced for a variety of subprovincial areas.¹² This chapter describes the methods used by Statistics Canada to calculate postcensal and intercensal demographic estimates by age and gender of subprovincial areas. The types of areas are divided based on the similarities between their estimation method.

Population estimation methods for census metropolitan areas, census agglomerations, census divisions and economic regions are covered within one section as they all use the cohort-component method. Estimation method for census subdivisions population, which is derived from tax data, is covered separately, so are population estimates for health regions and peer groups. The last section covers the method used for calibrating subprovincial estimates by age and gender to ensure coherence with their provincial and territorial counterparts.

Census metropolitan areas, census agglomerations, census divisions, and economic regions

Population estimates for census metropolitan areas (CMAs), census agglomerations (CAs), census divisions (CDs) and economic regions (ERs) are produced using the cohort-component method, like that used for provincial and territorial population estimates by age and gender. The method is applied separately to each subprovincial region.

Unlike population estimates for provinces and territories, those subprovincial population estimates are produced directly by age and gender with no total subprovincial population estimates derived first.

The principle of population estimation for those areas is like that described in the chapter on [Population estimation methods - Canada, provinces and territories](#), except that it is applied to each individual subprovincial regions. In this case, components of population change must also have been calibrated so their regional aggregate is coherent with the same component at the provincial or territorial level. Further details on the calculations behind postcensal and intercensal population estimates can be found in the aforementioned chapter.

The cohort-component method for subprovincial areas includes an additional component of population change, that of intraprovincial migration. It is represented by intraprovincial in-migrants and intraprovincial out-migrants, capturing the movement of people between subprovincial regions of a same province or territory. Like interprovincial migration at the national level, these subprovincial migrants do not impact the overall population of the parent province or territory but do impact the population of individual regions.

Subprovincial estimates for economic regions are derived from an aggregation of census divisions components of population change. Population estimates are then derived from those aggregated components of population change using the cohort-component formula. Because the process is different, subprovincial estimates for economic regions are described separately.

Definitions and concepts

A census metropolitan area (CMA) or a census agglomeration (CA) is formed by one or more adjacent municipalities centered on a population centre (known as the core). A CMA must have a total population of at least 100,000 based on data from the current Census of Population Program, of which 50,000 or more must live in the core based on adjusted data from the previous Census of Population Program. A CA must have a core population of at least 10,000 also based on data from the previous Census of Population Program.

To be included in the CMA or CA, other adjacent municipalities must have a high degree of integration with the core, as measured by commuting flows derived from data on place of work from the previous Census Program. More details on the rules to delineate and define a CMA can be found in the *Dictionary, Census of Population, 2021*.¹³

12. Subprovincial area refers to a region of the standard geographical classification (SGC) that subdivide provinces and territories. There may be exceptions, such as the Yukon census division being geographically equal to the territory, but the individual area is still part of the census division SGC. The term subprovincial areas is used for brevity but also includes and refers to subterritorial areas.

13. Statistics Canada. (2021). [Dictionary, Census of Population, 2021](#)

The components of population change are calculated at the same time for census metropolitan areas (CMAs) and census agglomerations (CAs), as well as for areas outside CMAs and CAs of each province and territory, as these regions are all mutually exclusive.

Census divisions (CDs) are group of neighboring municipalities joined together for the purposes of regional planning and managing common services (such as police or ambulance services). These groupings are established under laws in effect in certain provinces of Canada. Census division is the general term for provincially legislated areas (such as county, *municipalité régionale de comté* (MRC)¹⁴ and regional district) or their equivalents. In other provinces and the territories where laws do not provide for such areas, Statistics Canada defines equivalent areas for statistical reporting purposes in cooperation with these provinces and territories. Census divisions are intermediate geographic areas between the province and territory level and the municipality (census subdivision), except in Yukon, where the census division covers the entire territory.¹⁵

An economic region (ER) is a grouping of complete CDs (with one exception in Ontario) created as a standard geographic unit for analysis of regional economic activity.¹⁶ Within the province of Quebec, economic regions (*régions administratives*) are designated by law. In all other provinces and territories, economic regions are created by agreement between Statistics Canada and the province or territory concerned. Prince Edward Island and the three territories each consist of a single ER each. There exists one exception where the ER boundary does not respect census division boundaries: the census division of Halton, in Ontario, is split between the ER of Hamilton–Niagara Peninsula and the ER of Toronto.

Postcensal population estimates

Postcensal population estimates for census metropolitan areas, census agglomerations, census divisions and economic regions by age and gender – preliminary, updated, and final – are produced using the cohort-component method. This method consists in taking the population figures from the most recent census, adjusted for census net undercoverage¹⁷ (CNU), including incompletely enumerated reserves and settlements,¹⁸ and adding components of population change (births, deaths, and components of international and internal migration) to obtain population for a later reference date.

Postcensal population estimates by age and gender for census metropolitan areas, census agglomerations, and census divisions

The cohort-component method is used to produce estimates for census metropolitan areas (CMAs), census agglomerations (CAs) and census divisions (CDs) by age and gender. The method is applied to each age-gender cohort in the base population.

The cohort-component method formulas for estimating the population of CMAs, CAs and CDs by age and gender are as follows:

At age 0:

Equation 2.1:

$$P_{(t+1)}^0 = B_{(t,t+1)} - D_{(t,t+1)}^{-1} + I_{(t,t+1)}^{-1} - E_{(t,t+1)}^{-1} + RE_{(t,t+1)}^{-1} + \Delta NPR_{(t,t+1)}^{-1} + \Delta Inter_{(t,t+1)}^{-1} + \Delta Intra_{(t,t+1)}^{-1}$$

For ages 1 to 99:

14. In Québec, 93 of the 98 census divisions correspond to individual *municipalité régionale de comté* (MRC) when reserves are included. However, with Québec having a total of 104 MRC, the remaining five census divisions consist of two or three MRC each.

15. Statistics Canada. (2021). [Dictionary, Census of Population, 2021](#)

16. Statistics Canada. (2021). [Dictionary, Census of Population, 2021](#)

17. The CNU by age and gender for subprovincial areas was produced using a model-based methodology as reliable estimates were not available due to insufficient sample size.

18. Unless otherwise specified, the CNU always includes incompletely enumerated reserves and settlements.

Equation 2.2:

$$P_{(t+1)}^{(a+1)} = P_t^a - D_{(t,t+1)}^a + I_{(t,t+1)}^a - E_{(t,t+1)}^a + RE_{(t,t+1)}^a + \Delta NPR_{(t,t+1)}^a + \Delta Inter_{(t,t+1)}^a + \Delta Intra_{(t,t+1)}^a$$

For the age group of people aged 100 years and older:

Equation 2.3:

$$P_{(t+1)}^{100+} = P_t^{99+} - D_{(t,t+1)}^{99+} + I_{(t,t+1)}^{99+} - E_{(t,t+1)}^{99+} + RE_{(t,t+1)}^{99+} + \Delta NPR_{(t,t+1)}^{99+} + \Delta Inter_{(t,t+1)}^{99+} + \Delta Intra_{(t,t+1)}^{99+}$$

Where:

$(t, t+1)$	= interval between times t and t+1;
a	= age;
$P_{(t+1)}$	= estimate of the population at time t+1;
P_t	= base population at time t;
B	= number of births;
D	= number of deaths;
I	= number of immigrants;
E	= number of emigrants;
RE	= number of returning emigrants;
ΔNPR	= net non-permanent residents;
$\Delta Inter$	= net interprovincial migrants;
$\Delta Intra$	= net intraprovincial migrants.

In the equations above, an age of -1 refers to the cohort who had a demographic event at age 0 during the interval (t, t+1) but who was not born at the beginning of the time interval. The same calculations are used to obtain preliminary postcensal, updated postcensal and definitive postcensal population estimates by age and gender.

Each subprovincial component must have been calibrated to its provincial or territorial parent component by age and gender using the two-way raking method described later in this chapter. This ensures coherence between estimates produced by Statistics Canada at different geographical levels. Intraprovincial migration is not calibrated as it does not have an equivalent at the provincial or territorial level.

Special treatment for postcensal estimates for Quebec

Quebec's postcensal population estimates by age and gender at the of CDs, CMAs and CAs are calculated in accordance with the equations of the cohort-component method presented above. However, preliminary and updated components of births, deaths, and all revision levels of intraprovincial migration, are directly provided by the *Institut de la statistique du Québec* (ISQ) estimates. Components provided are coherent with provincial parent component produced by Statistics Canada.

Postcensal population estimates by age and gender for economic regions

A slightly different process is involved in the production of population estimates for economic regions (ERs), although population is still derived using the cohort-component method. In this case, the census division's (CD) aggregate method is used. First, ERs are defined in terms of CDs using the most recent Standard Geographical Classification (SGC) specifications. When the geographic delineation of the CDs and ERs are the same, no

adjustment is required; the estimates for demographic components for the CDs that make up the ER are simply added together.

However, when the geographic delineation of the CD does not match that of the ER, i.e., when a CD is in more than one ER, distribution of the CD's demographic components is allocated based on its demographic weight in each ER in question. The proportions are referred to as geographical conversion factors. They are calculated using the most recent census counts.

Thus, demographic components (births, deaths and migration) initially measured at the CD level can be allocated to each ER. Using the census division's aggregate method by the ERs' geographic delineation, the demographic components of ERs can be estimated. With those CD components converted to the ER geography, the cohort-component formula described earlier is applied to derive ER population estimates.

The census division's aggregate method must be used with caution, particularly when used to estimate the number of intraprovincial in-migrants and out-migrants, since it overestimates those figures. In-migrants to a given CD from another CD in the same ER should not be counted since the migration occurred within the ER's boundaries. These would result in false in-migrants. The same is true for out-migrants from one CD to another CD in the same ER. However, the net intraprovincial migration calculated with the CD aggregate method is correct because the false in-migrants and out-migrants cancel each other out. As a result, only the net intraprovincial migration of ERs can be estimated accurately using the CD aggregate method. Hence, estimates for intraprovincial in-migrants and out-migrants are not available at the ER level.

Intercensal population estimates

Intercensal estimates for census divisions (CDs), census metropolitan areas (CMAs), census agglomerations (CAs) and economic regions (ERs) are produced much in the same manner as intercensal estimates at the provincial and territorial level (see *Population estimation method – Canada, provinces and territories* chapter for information on the methods). There are three main steps in the production of intercensal estimates:

- the correspondence of the geographic boundaries between the two censuses;
- calculation of the error of closure;
- linear distribution of the error of closure (residual deviation).

To ensure geographical concordance, the base populations and components of population growth must be adjusted according to geographical boundaries at the time of the most recent census. For areas whose geographical boundaries changed between the two censuses (as measured by the standard geographical classification), historical conversion factors — derived from geographical boundary changes between two consecutive censuses — are used based on population transfers at the census subdivision level during the most recent intercensal period. In general, corrections to CDs, CMAs, CAs, and ERs are minor.

Error of closure is defined as the difference between postcensal population estimates on census day and the population enumerated in that census adjusted for census net undercoverage (CNU). The error of closure is spread evenly over the intercensal period, based on the number of days in each month. Intercensal estimates by age and gender are adjusted the same way (i.e., by distributing the error of closure evenly across the age and gender cohorts). As with postcensal estimates, the intercensal subprovincial estimates by age and gender are adjusted to provincial and territorial estimates using two-way raking to ensure their consistency.

With the addition of the residual deviation component of population change resulting from the calculation of intercensal population estimates, the cohort-component formula of intercensal population estimates for CDs, CMAs, CAs and ERs becomes:

At age 0:

Equation 2.4:

$$P_{(t+1)}^0 = B_{(t,t+1)} - D_{(t,t+1)}^{-1} + I_{(t,t+1)}^{-1} - E_{(t,t+1)}^{-1} + RE_{(t,t+1)}^{-1} + \Delta NPR_{(t,t+1)}^{-1} + \Delta Inter_{(t,t+1)}^{-1} + \Delta Intra_{(t,t+1)}^{-1} + Resid_{(t,t+1)}^{-1}$$

For ages 1 to 99:

Equation 2.5:

$$P_{(t+1)}^{(a+1)} = P_t^a - D_{(t,t+1)}^a + I_{(t,t+1)}^a - E_{(t,t+1)}^a + RE_{(t,t+1)}^a + \Delta NPR_{(t,t+1)}^a + \Delta Inter_{(t,t+1)}^a + \Delta Intra_{(t,t+1)}^a + Resid_{(t,t+1)}^a$$

For the age group of people aged 100 years and older:

Equation 2.6:

$$P_{(t+1)}^{100+} = P_t^{99+} - D_{(t,t+1)}^{99+} + I_{(t,t+1)}^{99+} - E_{(t,t+1)}^{99+} + RE_{(t,t+1)}^{99+} + \Delta NPR_{(t,t+1)}^{99+} + \Delta Inter_{(t,t+1)}^{99+} + \Delta Intra_{(t,t+1)}^{99+} + Resid_{(t,t+1)}^{99+}$$

Where:

- $(t, t + 1)$ = interval between times t and t+1;
- a = age;
- $P_{(t+1)}$ = estimate of the population at time t+1;
- P_t = base population at time t;
- B = number of births;
- D = number of deaths;
- I = number of immigrants;
- E = number of emigrants;
- RE = number of returning emigrants;
- ΔNPR = net non-permanent residents;
- $\Delta Inter$ = net interprovincial migrants;
- $\Delta Intra$ = net intraprovincial migrants;
- $Resid$ = residual deviation.

Census subdivisions

A different method is used to produce population estimates for census subdivisions (CSDs) than for other subprovincial geographies. CSD postcensal population estimates are based on the latest census counts adjusted for census net undercoverage (including adjustment for incompletely enumerated reserves and settlements) — as with other subprovincial geographies — and on the estimated population growth that occurred since that census, as calculated using tax data instead of the cohort-component method. Intercensal estimates are based on postcensal estimates with linearly distributed error of closure.

Population estimates for CSDs in Quebec are provided by the *Institut de la statistique du Québec* (ISQ). Population estimates for CSDs in Alberta are provided by Alberta's *Office of Statistics and Information* (OSI) in current geography for July 1, 2016, and after. They are converted to the most recent standard geographical classification (SGC) using geographical relationships provided by OSI.¹⁹ CSD population estimates for Alberta prior to July 1, 2016, are produced by Statistics Canada using the same method adopted for provinces and territories that do not provide their own estimates.

19. Due to this geographical difference, small discrepancies may exist between CSD populations released by Statistics Canada for Alberta and those found directly on Alberta's [Office of Statistics and Information](#).

Census subdivision population estimates for the Yukon territory are supplied by the *Yukon Bureau of Statistics*²⁰ for July 1, 2019, and after.²¹ Population estimates for census subdivisions in Northwest Territories are provided by the *Northwest Territories Bureau of Statistics* for July 1, 2001, and after.²²

Definitions and concepts

Census subdivision (CSD) is the general term for municipalities (as determined by provincial or territorial legislations) or areas treated as municipal equivalents for statistical purposes (e.g., reserves, settlements and unorganized territories). Municipal status is defined by laws in effect in each province and territory in Canada.²³

Postcensal population estimates by age and gender for census subdivisions

Since components of population change are not produced at the CSD level, the population of CSDs is not estimated using the cohort-component method, as is done with other levels of geography.

The method instead consists in using tax administrative data to calculate the change in the population of CSDs between two annual periods. These changes, expressed as a percentage, are then applied to the adjusted census populations of the CSDs. The process is repeated for subsequent years. The calculation of estimates by age and gender at the CSD level is based on the age and gender structures specific to each CSD for the previous year. Using the two-way raking method, the data are then adjusted to those of the census divisions (CDs) produced for the current year using the cohort-component method. This approach ensures consistent aging of CSD cohorts without resorting to age and gender details from tax data, which could introduce coverage biases associated with these variables. Moreover, this calibration ensures consistency between the CSD and CD population estimates.

Preliminary CSD total postcensal population estimates are derived from changes observed in the number of tax filers in the T1 file provided by the Canada Revenue Agency (CRA) over two consecutive years. Updated and final CSD total postcensal population estimates are derived from changes observed in the T1 Family File (T1FF), which typically becomes available a year after the T1 file but includes tax filers and their dependents.

At the CSD level, the base population is the censal population counts by age and gender adjusted for coverage errors and other adjustments. The census data are adjusted as follows:

- Adjustment of the population for census net undercoverage (CNU).
- Addition of independent population estimates for incompletely enumerated reserves and settlements by age and gender.
- Integration of formal reviews.

T1 and T1FF microdata are prepared by removing unnecessary records (emigrants, deceased persons, etc.). Each record in the T1 and T1FF are assigned a CSD geographic code based on their postal code using the PCCF+,²⁴ a file that contains weighted correspondences between postal codes and various geographical codes.

There are four steps to estimate the population of CSDs which are described below:

1. determine the number of people in each CSD based on the T1 or T1FF for each annual file;
2. calculate the annual total population changes for each CSD;
3. apply the annual total population changes to the base population of each CSD; and
4. derive CSD population by age and gender by calibrating to CD postcensal estimates to ensure consistency across estimation products.

20. [Yukon Bureau of Statistics](#)

21. Variations in total population estimates at the territorial level between both sources are due to methodological differences.

22. Data for unorganized regions within the Northwest Territories are suppressed, resulting in total population estimate variations when comparing to estimates produced by Statistics Canada for other levels of geography

23. Statistics Canada. (2021). [Dictionary, Census of Population, 2021](#)

24. Statistics Canada. (2017). [Postal Code^{mi} Conversion File Plus \(PCCF+\)](#)

Calculating the number of people per CSD

The first step consists in determining the number of people in each CSD based on the T1 or T1FF, which have been geocoded using the PCCF+. The coverage rate of the population in the T1FF is not necessarily 100%. As a result, CSD population estimates are not based directly on these counts directly. Instead, the counts are used to calculate annual change to population (expressed as rates) in the following step. It is assumed that coverage rate of the population in the administrative data remains constant over the postcensal period.

Calculating annual population changes for each CSD

Based on two consecutive annual tables of population counts by CSD, total annual change in the population is calculated as follows:

Equation 2.7:

$$Change_{(t,t+1)}^x = \frac{N_{T1/T1FF(t+1)}^x - N_{T1/T1FF(t)}^x}{N_{T1/T1FF(t)}^x}$$

Where:

$Change_{(t,t+1)}^x$ = Change rate for CSD x between time t and $t+1$;

$N_{T1/T1FF(t)}^x$ = Counts of population geocoded to CSD x within the T1 or T1FF file at time t .

If, for a given CSD, the denominator used to calculate the population change equals 0, the rate change in the CD in which that CSD is located is used instead.

The annual population changes calculated above are not necessarily used in full to calculate population estimates. Although the administrative data used are of high quality, they were not collected specifically for the purpose of measuring population growth. That can lead to unexpected variations, particularly for small CSDs. To avoid applying inaccurate population changes, an algorithm was developed to replace annual variations deemed incorrect or potentially unreliable.

Annual changes in the population of CSDs are used in full when the following conditions are met:

- The adjusted census base population of the CSD must be equal to or higher than 250.
- The coverage rate of the CSD, expressed as the ratio of the T1FF population to the adjusted census base population, must be within an acceptable range.
- The population change must be within an acceptable range for the annual reference period and for the previous and subsequent annual periods.

The acceptable thresholds and levels were determined using several tests aimed at minimizing the error of closure, one of the main quality indicators of population estimates.

When at least one of the conditions listed above is not met, the annual change in the CSD population is not used and is replaced by the annual population change rate of the corresponding CD.

Applying the annual population changes to the base population of each CSD

The annual change is applied to the total adjusted census population at the beginning of the censal cycle. For example, to estimate the postcensal population as of July 1, 2021, the annual change in the population for the 2020 to 2021 period is applied to the total adjusted census population for 2021. Since this base population is as of May 11, 2021 (Census Day), a ratio corresponding to the fraction of the year between the census date and July 1 is also applied. The formula for population estimates for a partial year would be:

Equation 2.8:

$$Pop_{(t+1)}^x = Pop_{(census)}^x + \left[\frac{Days_{(census,t+1)}}{Days_{(t,t+1)}} * Change_{(t,t+1)}^x \right] * Pop_{(census)}^x$$

Where:

- $Pop_{(t+1)}^x$ = Population of CSD x at time $t+1$;
 $Pop_{(census)}^x$ = Adjusted census population of CSD x ;
 $Change_{(t,t+1)}^x$ = Annual population change rate for CSD x between time t and $t+1$;
 $Days_{(census,t+1)}$ = Number of days between Census Day and $t+1$;
 $Days_{(t,t+1)}$ = Number of days between time t and $t+1$.

For subsequent, complete annual periods, the formula can be reduced to:

Equation 2.9:

$$Pop_{(t+1)}^x = Pop_{(t)}^x + (Change_{(t,t+1)}^x * Pop_{(t)}^x)$$

After total population is derived for a new period, it is calibrated so that the sum of CSD populations is coherent with their parent CD total population estimates, as previously calculated using the cohort-component method. The annual population change rate for the next period is applied to this calibrated population and so on until total population estimates for all required periods have been derived.

Deriving CSD postcensal population estimates by age and gender

Until this point, only total CSD population estimates have been derived. While very complete, tax data is not a demographic dataset, and variables of age and gender cannot be reliably used for small subprovincial regions. In particular, the coverage rate of tax data varies considerably according to age and gender variables. Overall, the total population growth rates obtained from tax data for CSDs have been found to be of excellent quality, but the age and gender distributions are obtained separately.

To obtain a CSD population by age and gender, the annual growth rate by gender and for single year of age is derived at the CD level. Those rates are applied to the CSD base populations by age and gender, then adjusted so that they sum up to the annual totals derived prior for each CSD using tax data.

The resulting CSD population estimates by age and gender are then calibrated using the two-way raking method to their parent CD by age and gender. The same method is used for postcensal preliminary, updated and final population estimates, though updated and final population estimates are derived from T1FF data, while preliminary estimates are derived from T1 data. CSD population estimates are always assigned the same estimation level as that of the CD estimates used to calibrate them.

Intercensal population estimates by age and gender for census subdivisions

The calculation of intercensal population estimates by age and gender for census subdivisions is relatively simpler since they are not calculated using components of population change. No residual deviation must be calculated, but the error of closure still must be distributed for each CSD (see chapter on [Population estimation methods – Canada, provinces and territories](#) for more details).

For each CSD, the error of closure by age and gender is distributed linearly between intercensal years, adding it to the previously existing postcensal estimates after they have been converted to the new standard geographical

classification, when necessary. The result is then calibrated to the parent CD intercensal population estimates by age and gender to ensure they are coherent.

Population estimates for health regions and peer groups

Health regions are legislated administrative areas defined by provincial ministries of health. These administrative areas represent geographic areas of responsibility for hospital boards or regional health authorities. Health regions, being provincial administrative areas, are subject to change. For complete national coverage, each of the territories also represents a health region.²⁵

For the most part, health regions can be described as groupings of counties (census divisions) or municipalities (census subdivisions). This description holds especially true in the Atlantic provinces, Quebec, and Ontario (with minor exceptions in northern Ontario). In the Western provinces, health regions are less likely to follow census division or census subdivision boundaries.

Population estimates for health regions and peer groups, both intercensal and postcensal, are obtained by a process of geographical conversion of census subdivisions. The process is like what is outlined above regarding the components of population change for economic regions. A population-weighted geographical correspondence is derived from census counts between CSDs and individual health regions and peer groups. CSD population estimates by age and gender are aggregated following this correspondence table and summed to health regions and peer groups.

To ensure consistency with population estimates of other geographical units, and since the relationship between geographies can be fractional, the resulting health regions and peer groups population estimates are calibrated to the population estimates of their respective provinces or territory.

Population estimates by age and sex at birth

In addition to estimates by age and gender, population estimates by age and sex at birth for some selected subprovincial areas are produced on an annual basis and are also available upon request. They are calculated using the annual subprovincial population estimates by age and gender, to which ratios derived from the 2021 Census data are applied to obtain numbers for men and women by single year of age. The two series of estimates (by gender and by sex at birth) must be treated separately and are not designed to be cross-tabulated. Therefore, users should use caution when comparing the estimates from the two series. It is not possible to obtain estimates of transgender, cisgender, or non-binary persons by combining the information from these two series of estimates.

Population estimates by age and sex at birth for subprovincial areas are assigned the same estimation level as that of the population estimates by age and gender for the same reference period to which the ratios are applied.

Calibration of subprovincial estimates

Calibration, also known as prorating or two-way raking,²⁶ is a process through which data for a lower level of geography is adjusted so that its totals by age and gender are coherent with those of a higher level of geography for coherence within the Demographic estimates system. Components of population change and populations, can be calibrated.

Definitions and concepts

For a given reference date, provincial and territorial demographic estimates (components of population change and population) are produced and released before subprovincial estimates. Hence, subprovincial estimates must be calibrated to their provincial and territorial counterparts for coherence. For example, the sum of men+ immigrants aged 19 across all census divisions in Ontario must be equal to the number of men+ immigrants aged 19 previously calculated for the province of Ontario.

25. Statistics Canada. (2024). [Health Regions: Boundaries and Correspondence with Census Geography](#)

26. Shryock, H.S., Siegel J.S., et al. (1976). *The Methods and Materials of Demography*, 547-549. Academic Press, San Diego.

Calibration is always done between two levels of geography where the lower one – or child region – as a set of external boundaries that cover the entirety of the higher level – the parent region. Census divisions can be calibrated to their respective province or territory for example. It is best to calibrate two levels of geography which are not too dissimilar to avoid redistribution effects from that might otherwise affect very small regions disproportionately. For this reason, census metropolitan areas, census agglomerations, census divisions, economic regions and health regions and peer groups are calibrated to their parent province or territory while census subdivisions are calibrated to previously calibrated census divisions which contain them.

In the absence of a distribution by age, births are calibrated by gender only to their parent total before a rounding algorithm is applied to ensure only whole values remain.

Intraprovincial migration cannot be calibrated to a provincial or territorial equivalent due to the component only existing for subprovincial areas. Instead, intraprovincial in-migrants and out-migrant components are used as is without calibration. The production of intraprovincial migration components does however ensure that the number of in-migrants is equal to the number of out-migrants within each province and territory as such movements do not impact their total population.

Two-way raking by age and gender

A subprovincial distribution — referring here to data for a component of population change or population before calibration — at the lower level of geography (child distribution) and a component at a higher level of geography (parent component) are required to apply two-way raking calibration. The subprovincial child distribution is defined as $D(p, r, a, g)$, while the parent calibrated component is represented by $C_{ag}(p, a, g)$, with province p , subprovincial region r , age and gender g . The number of regions in each of the parent or child geography can vary.

The first step is to correct the child distribution, so it is coherent with the parent component. There could be zeroes in the distribution, making calibration impossible if the parent component is itself non-zero. The child distribution is corrected as follows:

Equation 2.10:

$$D'(p, r, a, g) = D(p, r, a, g) + 0.0000001$$

Next, the total distribution of each child region within their parent region is calculated. The child distribution and parent component are summed across all ages:

Equation 2.11:

$$D_{reg}(p, r, g) = \sum_a D'(p, r, a, g)$$

Equation 2.12:

$$C_{tot}(p, g) = \sum_a C_{AG}(p, a, g)$$

The proportion of a parent component for a given province p and gender g represented by the child distribution of region r is then:

Equation 2.13:

$$C_{reg}(p, r, g) = \frac{D_{reg}(p, r, g)}{\sum_i D_{reg}(p, i, g)} C_{tot}(p, g)$$

From the proportion derived above, intermediate distribution by parent region, child region, age and gender is calculated as:

Equation 2.14:

$$C_{temp}(p, r, a, g) = \frac{D'(p, r, a, g)}{\sum_i D'(p, r, i, g)} C_{reg}(p, r, g)$$

With this distribution, the child distribution by gender $C_{reg}(p, r, g)$, and the parent component by age and gender $C_{AG}(p, a, g)$, calibration is obtained through an iterative process as follows:

1. C_{temp} is calibrated to the parent region component by age and gender:

Equation 2.15:

$$C_{temp}(p, r, a, g) = \frac{C_{AG}(p, a, g)}{\sum_i C_{temp}(p, i, a, g)} C_{temp}(p, r, a, g)$$

2. C_{temp} is calibrated to the child region distribution by gender:

Equation 2.16:

$$C_{temp}(p, r, a, g) = \frac{C_{reg}(p, r, g)}{\sum_i C_{temp}(p, r, i, g)} C_{temp}(p, r, a, g).$$

3. The maximum absolute difference between C_{temp} and C_{AG} is obtained as:

Equation 2.17:

$$diff_{AG} = \max\left(\left|\left(\sum_r C_{temp}(p, r, a, g)\right) - C_{AG}(p, a, g)\right|\right)$$

4. If the maximum difference is larger than a given value (typically set at 0.00001), then iterations continue by going back to step 1. If not, then convergence has been achieved, and the calibration process ends.

Theoretically, the algorithm should converge in all cases. However, a limit on the number of iterations should be set within the calibration system so data problems don't lead to an infinite loop.

At the end of the process, the resulting $C_{temp}(p, r, a, g)$ will be coherent with the parent component, but will be unrounded.

All components of population change, as well as population estimates, are meant to represent individuals. As a result, all data must be rounded to whole numbers. This must be done while maintaining coherence with parent region control totals.

Rounding is applied across $C_{temp}(p, r, a, g)$ and independently for each group of child regions within each parent region by age and gender. The algorithm is designed to not create negative values when distributing the difference. It can however add a person to a child region with a total of 0 before the rounding step. Each addition in a child region is balanced with a subtraction in another child region with the same parent and vice versa. This ensures each group of child regions remains coherent with its parent region distribution by age and gender, leading to a component for child regions that is calibrated and coherent with its parent component.

Chapter 3

Base population

Censuses play an essential role in calculating population estimates. Every five years, population estimates are linked to the results of the last census to calculate a new base population. The Demographic Estimates Program's (DEP) base population corresponds to the population used as a reference point or a starting point for the estimation process.

For postcensal estimates, the base population is the population enumerated at the last census, adjusted for census net undercoverage (CNU), incompletely enumerated reserves and settlements (IERS), and demographic adjustments at certain ages. Formal reviews of population counts are also included at the subprovincial and subterritorial levels. The base population is also referred to as the censal estimate. The reference date for the censal estimate is the same as the date of the corresponding census.

Postcensal estimates as of July 1st of a census year are calculated using the component method based on the base population and take into account demographic events that occurred between Census Day and June 30. Intercensal estimates are derived from postcensal estimates corrected for error of closure. Error of closure is the difference between the base population and the postcensal estimate on the same census date. [Chapter 13](#) of this guide presents the quality measures of population estimates.

This chapter presents the methodology for calculating each component of the DEP base population. It also includes the methods used to calculate the base population by age and gender, as well as for subprovincial and subterritorial estimates.

Base population by province and territory

At the provincial and territorial level, the base population is calculated as follows:

$$Pop = Census\ counts + CNU + IERS$$

The DEP base population makes the following corrections and additions to the census data:

- Adjustment of the population to account for CNU.
- Addition of independent estimates of the population of IERS in 1991, 1996, 2001, 2006, 2011, 2016 and 2021.
- Addition of demographic adjustments to certain ages. These adjustments do not affect the provincial/territorial total of the base population.
- Adjustment for early enumeration in parts of northern Quebec, Newfoundland and Labrador, Yukon and the Northwest Territories in 1991 and 1996.
- Addition of estimates of non-permanent residents in 1971, 1976, 1981 and 1986. Since 1991, non-permanent residents have been included in the census universe.

The table below illustrates the various components that make up the base population, by province and territory from 2001 to 2021.

Table 3.1
Estimated census net undercoverage, Canada, provinces and territories, 2001 to 2021 censuses

Geography	Census population	Census net undercoverage	Incompletely enumerated reserves and settlements	Adjusted population	Rate
	A	B	C	D=A+B+C	(B+C)/D*100
		number			percent
2021					
Canada	36,991,981	1,142,239	58,480	38,192,700	3.14
Newfoundland and Labrador	510,550	16,234	0	526,784	3.08
Prince Edward Island	154,331	6,901	0	161,232	4.28
Nova Scotia	969,383	27,852	0	997,235	2.79
New Brunswick	775,610	13,624	0	789,234	1.73
Quebec	8,501,833	42,868	18,759	8,563,460	0.72
Ontario	14,223,942	585,370	18,693	14,828,005	4.07
Manitoba	1,342,153	39,283	9,063	1,390,499	3.48
Saskatchewan	1,132,505	34,912	11	1,167,428	2.99
Alberta	4,262,635	153,165	11,108	4,426,908	3.71
British Columbia	5,000,879	212,846	846	5,214,571	4.10
Yukon	40,232	2,467	0	42,699	5.78
Northwest Territories	41,070	3,589	0	44,659	8.04
Nunavut	36,858	3,128	0	39,986	7.82
2016					
Canada	35,151,728	849,727	27,790	36,029,245	2.44
Newfoundland and Labrador	519,716	9,774	0	529,490	1.85
Prince Edward Island	142,907	3,464	0	146,371	2.37
Nova Scotia	923,598	17,809	0	941,407	1.89
New Brunswick	747,101	15,735	0	762,836	2.06
Quebec	8,164,361	35,191	11,985	8,211,537	0.57
Ontario	13,448,494	381,542	11,640	13,841,676	2.84
Manitoba	1,278,365	31,895	0	1,310,260	2.43
Saskatchewan	1,098,352	34,844	0	1,133,196	3.07
Alberta	4,067,175	115,968	4,043	4,187,186	2.87
British Columbia	4,648,055	197,267	122	4,845,444	4.07
Yukon	35,874	2,370	0	38,244	6.20
Northwest Territories	41,786	2,939	0	44,725	6.57
Nunavut	35,944	929	0	36,873	2.52
2011					
Canada	33,476,688	759,125	37,392	34,273,205	2.32
Newfoundland and Labrador	514,536	10,192	0	524,728	1.94
Prince Edward Island	140,204	3,386	0	143,590	2.36
Nova Scotia	921,727	21,911	0	943,638	2.32
New Brunswick	751,171	3,930	0	755,101	0.52
Quebec	7,903,001	73,240	16,882	7,993,123	1.13
Ontario	12,851,821	369,874	14,926	13,236,621	2.91
Manitoba	1,208,268	21,698	608	1,230,574	1.81
Saskatchewan	1,033,381	29,580	768	1,063,729	2.85
Alberta	3,645,257	128,584	4,094	3,777,935	3.51
British Columbia	4,400,057	91,280	114	4,491,451	2.03
Yukon	33,897	1,356	0	35,253	3.85
Northwest Territories	41,462	1,977	0	43,439	4.55
Nunavut	31,906	2,117	0	34,023	6.22
2006					
Canada	31,612,897	868,658	40,115	32,521,670	2.79
Newfoundland and Labrador	505,469	5,046	0	510,515	0.99
Prince Edward Island	135,851	1,903	0	137,754	1.38
Nova Scotia	913,462	24,558	0	938,020	2.62
New Brunswick	729,997	16,059	0	746,056	2.15
Quebec	7,546,131	60,751	16,600	7,623,482	1.01
Ontario	12,160,282	465,824	15,391	12,641,497	3.81
Manitoba	1,148,401	34,330	0	1,182,731	2.90
Saskatchewan	968,157	22,594	739	991,490	2.35
Alberta	3,290,350	111,353	7,272	3,408,975	3.48
British Columbia	4,113,487	121,551	113	4,235,151	2.87
Yukon	30,372	1,805	0	32,177	5.61
Northwest Territories	41,464	1,620	0	43,084	3.76
Nunavut	29,474	1,264	0	30,738	4.11

Table 3.1
Estimated census net undercoverage, Canada, provinces and territories, 2001 to 2021 censuses

Geography	Census population	Census net undercoverage	Incompletely enumerated reserves and settlements	Adjusted population	Rate
	A	B	C	D=A+B+C	(B+C)/D*100
	number				percent
2001					
Canada	30,007,094	924,430	34,539	30,966,063	3.10
Newfoundland and Labrador	512,930	9,401	0	522,331	1.80
Prince Edward Island	135,294	1,325	0	136,619	0.97
Nova Scotia	908,007	24,521	0	932,528	2.63
New Brunswick	729,498	20,095	0	749,593	2.68
Quebec	7,237,479	140,232	12,648	7,390,359	2.07
Ontario	11,410,046	436,349	15,960	11,862,355	3.81
Manitoba	1,119,583	30,903	110	1,150,596	2.70
Saskatchewan	978,933	21,231	581	1,000,745	2.18
Alberta	2,974,807	69,857	4,977	3,049,641	2.45
British Columbia	3,907,738	164,542	263	4,072,543	4.05
Yukon	28,674	1,423	0	30,097	4.73
Northwest Territories	37,360	3,295	0	40,655	8.10
Nunavut	26,745	1,256	0	28,001	4.49

Note: The levels and rates are based on the Reverse Record Check (RRC), the Census Undercoverage Study (CUS) and the Census Overcoverage Study (COS). They include non-permanent residents.

Source: Statistics Canada, Centre for Demography.

Census

Census counts are the foundation of population estimates. Information on censuses and their universes and concepts can be found in the [introduction](#) in this guide.

Census net undercoverage

Census net undercoverage (CNU) measures census coverage errors, which are defined as errors caused by miscounting the population on Census Day.

There are two types of coverage errors. First, population undercoverage occurs when people who should have been counted were not, while population overcoverage counts those who should not have been counted or counts them more than once. Undercoverage is more common than overcoverage. The net impact of undercoverage and overcoverage on the size of the population is referred to as census net undercoverage (CNU).

Census coverage studies

After each census, Statistics Canada conducts coverage studies to measure coverage errors. Three studies examined coverage error in the 2021 Census. First, the 2021 Dwelling Classification Survey (DCS) examined coverage errors resulting from the misclassification of dwelling occupancy. Census data were corrected to account for this type of coverage error. Second, the Census Undercoverage Study (CUS), previously called the Reverse Record Check (RRC), measured population undercoverage. Third, the 2021 Census Overcoverage Study (COS) measured population overcoverage caused by some people being counted more than once by the census.

Census data are not adjusted for the population coverage errors measured by the CUS and COS. Instead, CNU estimates are used to produce Statistics Canada's population estimates.

More information on the methodology of the 2021 Census coverage studies is available in chapters 6 to 8 of the [Coverage Technical Report, Census of Population, 2021](#), Statistics Canada Catalogue no. 98-303-X.

Coverage studies provide undercoverage estimates in the 1991 to 2021 censuses at the provincial and territorial levels, and in the 1971 to 1986 censuses only at the provincial level. Estimates of overcoverage for the provinces and territories are only available as of the 1991 Census. To estimate overcoverage in censuses before 1991, it was assumed that the ratio of overcoverage to undercoverage for each census between 1971 and 1986 was the same as in 1991. To estimate the CNU for Yukon and the Northwest Territories prior to 1991, it was assumed that the ratio of the CNU for each territory to the 10 provinces for each census between 1971 and 1986 was the same as in 1991.

For consistency, the 1991 Census undercoverage and overcoverage estimates were revised in 1998 to reflect methodological improvements made to the 1996 Census coverage studies. This update changed the CNU for the 1971 to 1986 censuses. Similarly, the 1996 Census undercoverage and overcoverage estimates were revised in 2003.

The DEP requires an estimate of the CNU for various estimation domains. The CNU estimates from coverage studies have a good level of reliability for large domains (e.g., provinces and territories or broad age groups), but they are less accurate for smaller domains due to the small sample sizes in these domains. This is one reason why a demographic adjustment is required at certain ages; this will be described in another section of this chapter.

The CNU counts must be whole numbers (positive or negative). They must be produced for the estimation domains corresponding to the cross-tabulation of variables: province and territory, year of age, and gender. In addition, the modelled CNU figures, when summed across the areas of interest, must match the published CNU totals for the broad coverage study domains. In addition, the CNU must be a smooth function of the year of age. In other words, the evolution of the CNU from one year of age to the next must be regular and, ideally, should not fluctuate too rapidly and abruptly. The methodology for estimating the CNU by age and gender is presented later in this chapter.

Incompletely enumerated reserves and settlements

Enumeration is not authorized or cannot be completed on some reserves and settlements. These areas, which numbered 63 in the 2021 Census, are referred to as incompletely enumerated reserves and settlements (IERS). Health and safety restrictions put in place to slow the spread of COVID-19 as well as natural disasters that occurred during collection (including wildfires that led to evacuations) contributed to the partial enumeration of many reserves and settlements. As a result, 2021 Census population and dwelling counts are not available for the 63 IERS and are not included in the 2021 Census tabulations.

Neither the 2021 Census nor the CUS are able to produce estimates of the population living in IERS. A model-based methodology is used to produce official population estimates for these geographic areas.

An adjustment is then applied to the model-based estimates to account for CNU. This adjustment is based on national CNU estimates for enumerated reserves.

For more information on the methodology used to estimate IERS, please consult the following:

- Section 12.2 of the Coverage Technical Report, Census of Population, 2021, Statistics Canada Catalogue no. 98-303-X;
- Section 4.2 of the Indigenous Peoples Technical Report, Census of Population, 2021, Statistics Canada Catalogue no. 98-307-X.

Base population by age and gender

The components of the base population by age and gender and of the total population are the same, except for the addition of demographic adjustments at specific ages. These adjustments are necessary because the CNU can be less accurate at certain ages for which other reliable administrative data are available.

The base population by age and gender for each province and territory is calculated as follows:

$$Pop_{a,g} = Census\ counts_{a,g} + CNU_{a,g} + IERS_{a,g} + demographic\ adjustments_{a,g}$$

Where, for each province and territory:

a = age;

g = gender.

The table below shows the effect of the various adjustments to the census to calculate the base population by age group.

Table 3.2
Census adjustment rates by age group, 2001 to 2021 censuses, Canada

	2001	2006	2011	2016	2021
	percent				
All ages	3.10	2.79	2.32	2.44	3.14
0 to 4 years	3.38	1.91	0.95	2.14	3.81
5 to 9 years	2.18	0.96	-0.25	-0.94	0.86
10 to 14 years	1.07	0.95	0.08	-0.36	-0.71
15 to 19 years	2.93	3.14	2.90	2.90	2.27
20 to 24 years	7.09	7.56	6.76	5.98	8.70
25 to 29 years	8.26	8.88	8.26	6.97	9.53
30 to 34 years	6.38	6.83	6.70	6.09	6.58
35 to 39 years	4.62	4.95	4.12	4.66	4.80
40 to 44 years	2.70	4.14	2.51	3.55	3.91
45 to 49 years	1.49	1.73	1.91	2.93	3.16
50 to 54 years	1.33	0.66	0.98	2.36	2.47
55 to 59 years	1.14	0.00	0.03	1.53	1.94
60 to 64 years	0.69	-0.08	-0.27	0.51	1.43
65 to 69 years	0.75	-0.48	-0.41	-0.35	0.22
70 to 74 years	0.83	-0.73	-0.52	-0.99	-0.27
75 to 79 years	0.48	-0.48	-0.51	-1.36	-0.27
80 to 84 years	0.54	-0.70	-0.51	-1.15	-0.51
85 to 89 years	0.38	-0.33	-0.49	-0.89	-1.04
90 to 94 years	-0.14	-3.67	1.48	-0.76	-1.38
95 to 99 years	-1.99	-7.66	0.91	2.55	4.01
100 years and older	-8.27	-6.07	1.42	3.40	8.45

Note: The census adjustment represents the sum of census net undercoverage, incompletely enumerated reserves and settlements and demographic adjustment.

Source: Statistics Canada, Centre for Demography.

Census net undercoverage by age and gender

CNU estimates from coverage studies, which are calculated using samples, have a good level of reliability for large domains (such as provinces and territories or broad age groups). However, they are less accurate for smaller domains due to the small sample sizes in these domains. Therefore, a model better adapted to small domains is used to produce CNU estimates by year of age and gender for the provinces and territories: the Fay-Herriot model²⁷ or the empirical Bayes model. This model produces more accurate estimates in small domains, despite their potential bias. As a result, estimation using this model involves a trade-off between bias and variance of the CNU estimates.

A number of elements are needed to produce estimates using the Fay-Herriot model. Direct estimates and associated estimated variances are required for all domains of interest. Independent variables related to the CNU must also be available. The direct estimates used are of the log of the net undercoverage adjustment factors (ratio of the population count adjusted for coverage to the census population count) and are derived from the coverage studies estimates. These estimates are by province or territory, age group and gender. Age groups are used since direct estimates by year of age are considered too volatile to be successfully modelled. In the provinces, the age groups are as follows: 0 to 4 years; 5 to 9 years; 10 to 17 years; 18 to 24 years; 25 to 34 years; 35 to 44 years; 45 to 54 years; 55 to 64 years; 65 to 74 years; 75 to 84 years; and 85 years and older. In the territories, the age groups are the same up to age 64, followed by a single group for 65 years and older.

The independent variables come from the census questionnaire and include level of education, mobility, type of dwelling, tenure type, and mother tongue among others²⁸. The variable selection process is performed using Mallows' Cp criterion as well as other standard statistical selection processes and selection criteria, such as backward selection, forward selection, Akaike information criterion (AIC), and p-values. Mallows' Cp, which minimizes model error while applying a penalty to models with more variables, is used to obtain a relatively sparse model (one that has as few terms as possible but remains highly predictive).

27. Fay, R. E. and R. A. Herriot (1979). Estimates of Income for Small Places: An Application of James-Stein Procedures to Census Data. *Journal of the American Statistical Association*, 74(366a), 269-277.

28. For details about the candidate variables, see Dick, P. (1995). [Modelling net undercoverage in the 1991 Canadian census](#). *Survey Methodology* 21(1), 45-54.

Once the appropriate independent variables are selected, the parameters of the Fay-Herriot model are estimated using the restricted maximum likelihood method²⁹ The parameters estimated include the model variance and the regression coefficients. The model produces estimates of the log of the net undercoverage adjustment factor by province or territory, age group and gender.

Next, an assumption is required to produce the modelled estimates for the required domains, i.e., census net undercoverage by year of age and gender for each province and territory. This assumption is that the adjustment factor is constant for all years of age in a domain. For example, for a given province and gender, the correction factor for the CNU at age 1 is assumed to be the same as the one that will be applied at age 3, since both ages are in the 0-to-4 age group.

Formally, this is described as follows:

Equation 3.1:
$$\widehat{M}_{ijka} = C_{ijka} X(e^{\widehat{\log(F_{ijk})}} - 1)$$

where:

\widehat{M}_{ijka}	=	CNU for a given age a in province or territory i , gender j and age group k ;
C_{ijka}	=	number of persons counted in the census for a given age a in province or territory i , gender j and age group k ;
$\widehat{\log(F_{ijk})}$	=	log of the adjustment factor estimated by the Fay-Herriot model for province or territory i , gender j and age group k .

After modelling, the CNU estimates are no longer consistent with the coverage studies estimates. In other words, the total of the modelled estimates will not equal the CNU produced by the coverage studies in certain broad domains such as the provinces and territories. The modelled estimates must therefore be adjusted to restore coherence with the coverage studies. This adjustment is made by applying reconciliation methods³⁰ to the modelled CNU estimates, which ensures that the totals of the coverage studies are complied with while minimizing the changes made to the modelled estimates as much as possible. Reconciliation is also referred to as raking or balancing. Specifically, the modelled estimates must correspond simultaneously to two margins: the provincial and territorial totals and the smoothed national total by year of age.

The totals of the first margin are taken directly from the coverage studies and are used without being modified. The totals of the second margin are obtained by smoothing the direct estimates by year of age at the national level using the penalized B-spline technique.³¹ Smoothing is done because it is preferable for the CNU to evolve gradually from one year of age to the next and to not fluctuate too quickly and abruptly. The second margin is then calibrated³² to ensure they are consistent with the national estimates from the coverage studies for each of seven age groups (0 to 17 years; 18 to 24 years; 25 to 34 years; 35 to 44 years; 45 to 54 years; 55 to 64 years; and 65 years and older). Calibration is a technique that imposes the totals from coverage studies while preserving the trend of the smoothed margin as much as possible.

A consequence of the reconciliation process is that the modelled estimates generally exhibit a smoother trend than the equivalent direct estimates produced by the coverage studies. However, some jumps may still appear at the edge years of the age groups. To reduce the effect of these jumps, a smoothing process using splines is applied again to the modelled provincial and territorial estimates. Since this smoothing disrupts the coherence with the provincial and territorial totals from the coverage studies, it is followed by a prorating adjustment to restore coherence.

Finally, the CNU estimates by age and gender are rounded in a controlled fashion such that each estimate is rounded to a whole number while preserving the provincial and territorial totals. Most of the time, this controlled rounding is equivalent to rounding to the nearest whole number.

29. For more information on the estimation method, see Rao, J. N. K. and A. Molina (2015). *Small Area Estimation*, 2nd edition. Wiley.

30. Dagum, E. B. and P. Cholette (2006). *Benchmarking, Temporal Distribution, and Reconciliation Methods for Time Series*. Springer-Verlag, New York, Lecture Notes in Statistics, 186.

31. Eilers, P. H. C. and B. D. Marx (1996). Flexible smoothing with B-splines and penalties. *Statistical Science*, 11(2), 89–102.

32. Dagum, E. B. and P. Cholette (2006). *Benchmarking, Temporal Distribution, and Reconciliation Methods for Time Series*. Springer-Verlag, New York, Lecture Notes in Statistics, 186.

Incompletely enumerated reserves and settlements by age and gender

The method described above provides a provincial or territorial estimate of the population of incompletely enumerated reserves and settlements. Estimates by age and gender are obtained through distributions for each province and territory, based on enumerated reserves and settlements adjusted for CNU. The resulting distributions are applied to incompletely enumerated reserves and settlements. The resulting age and gender estimates are then rounded and adjusted to ensure coherence with the totals by province and territory.

Demographic adjustments

Adjustments are applied at age 0 and older ages because of greater variability in CNU estimates from coverage studies and the availability of alternative data sources at these ages.

Adjustment at age 0

The postcensal estimate of the population at age 0 is derived almost entirely from the estimated number of births (from vital statistics) the previous year. The estimate is therefore very reliable and can be used as a benchmark to adjust the census estimate. Census estimates for the population aged 0 are directly obtained by taking postcensal estimates of the same age to minimize inconsistencies with the vital statistics information. The methods for calculating births in the Demographic Estimates Program are described in the chapters on [births](#) and [deaths](#) in this guide.

The differences between census counts and the results of the demographic adjustment are redistributed among the population aged 5 to 74, by their relative weight per province or territory and gender. This way, the total population by province or territory remains unchanged.

Adjustment at advanced ages

An analysis of the age and gender structure of census counts and postcensal population estimates shows that the population at older ages, particularly those aged 95 and older, can be affected by overestimation or underestimation. Coverage studies fail to correct these differences due to the sample sizes at these ages. The type and scope of these errors in older populations can vary from one census to another, ranging from reporting errors (intentional or unintentional) to data entry and/or process errors.

The demographic adjustment at older ages is carried out using data from the Office of the Chief Actuary of Canada (OCA), the T1 Family File (T1FF) and the most recent mortality tables published by Statistics Canada.

Adjustments were made for the population aged 95 and older for the 2021 base population. Adjustments to the base population of previous years were made for the 90-and-older group.

Two methods were used to calculate this adjustment. The extinct cohort method was used for cohorts deemed to have no survivors. For these cohorts, population estimates were calculated based on the number of deaths from vital statistics. All deaths in each cohort are added to reconstruct its population based on the assumption that these cohorts will not experience any other demographic event.

For non-extinct cohorts (cohorts deemed to still have survivors), the adjustment for the 2021 base population used two data sources: administrative data from the OCA and the extinct cohorts (EC) estimates. For extinct cohorts from previous years, the relationship between the EC estimates and Old Age Security (OAS) data from the OCA is relatively stable. The demographic adjustment was calculated in two steps, using this relationship. First, average ratios of the EC data to the population estimates based on OAS data were calculated by province or territory, age and gender. Next, these ratios were applied to 2021 OAS population estimates for non-extinct cohorts.

For the base populations associated with previous censuses, the non-extinct cohorts were estimated using the survival ratio method. This method assumes that deaths from non-extinct cohorts are distributed by age like those from extinct cohorts. The population at a given age is estimated using the survival ratios of non-extinct cohorts based on the ratios of the last five extinct cohorts.

As for the demographic adjustment at age 0, the differences between census counts and the results of this demographic adjustment are redistributed among the population aged 5 to 74, by their relative weight by province or territory and by gender.

Base population for subprovincial geographies

The production of population estimates for subprovincial geographies requires the creation of a base population that is coherent with the provincial and territorial base population. The base population by age and gender is first calculated at the census subdivision (CSD) level, then the base populations for higher-level subprovincial geographies are obtained by aggregating CSD base populations.

The base populations of subprovincial geographies and the provinces and territories share many conceptual similarities, such as the same population universe. However, some differences must be considered to ensure that the subprovincial base population is representative of the adjustments that directly affect the CSD population.

The base population for subprovincial areas, derived at the CSD level, first considers census count modifications following a formal review process. Next, census net undercoverage and demographic adjustments are applied and the result is then calibrated to its equivalent at the provincial and territorial level to ensure coherence between all levels of geography. Finally, modelled population estimates for incompletely enumerated reserves and settlements are added to complete the subprovincial base population. These steps are described in more detail below.

Integrating modifications into census population counts

When Statistics Canada publishes population and dwelling counts from the census, data users sometimes question the validity of the figures for a particular geographic area, such as a municipality (census subdivision) or a submunicipal area (designated place). As a result, Statistics Canada implemented the [Policy on response to formal review requests of 2021 Census population and dwelling counts](#). If a correction is deemed necessary, which generally only affects a few CSDs each census, it is reviewed at the census subdivision (CSD) level.

Those count modifications are sent separately to the Demographic Estimates Program as they are not reflected in raw census counts for the CSDs in question. Since counts modified following a formal review are only provided as a revised total population, they are distributed so as to maintain the same distribution by age and gender as the original, uncorrected, census count for each CSD in question.

Census net undercoverage and demographic adjustments

To calculate the base populations for subprovincial areas, the corresponding provincial and territorial CNU rates, available by age and gender, are applied to the published census counts after accounting for population count modifications following formal reviews. In this synthetic estimate, it is assumed that, in a given province or territory and for a given age and gender, the CNU rate is constant across all levels of geography. For example, in British Columbia, the CNU rate for 20-year-old men is considered to be the same across the province.

By design, census coverage studies aim to provide accurate net undercoverage by age and gender for the provinces and territories. It would be impractical and costly to produce accurate results for subprovincial areas across the country since it would require a much larger sample. Those limitations are the reason why the net census undercoverage rate at the provincial and territorial level must be reused consistently across subprovincial areas when more specific data is not available.

For subprovincial areas, census net undercoverage and demographic adjustments by age and gender (described above in the section on demographic adjustments)—both of which are available only for the provinces and territories—are applied simultaneously to adjust CSD counts.

Calibration to the provincial and territorial population, excluding incompletely enumerated reserves and settlements

To maintain coherence with the provincial and territorial base population, the CSD adjusted population derived up to this point must be calibrated. This is done before including incompletely enumerated reserves and settlements (IERS), as these are the result of modelling that is not subject to the adjustments applied to other CSDs.

As a result, CSD adjusted populations by age and gender (excluding IERS) are calibrated with the base population of their respective province or territory, from which the IERS population has been subtracted. The two-way raking calibration process used is described in the chapter on [Population estimation methods – subprovincial areas](#).

To limit the impact the calibration process could have on the population distribution for subprovincial areas, the CSD adjusted populations by age and gender (excluding IERS) are first aggregated to obtain intermediate adjusted census division (CD) populations (excluding IERS) by age and gender. Those CD populations are first calibrated to their provincial and territorial counterparts from which IERS have been subtracted. The adjusted CSD populations by age and gender (excluding IERS) are then calibrated to these calibrated intermediate CD populations (excluding IERS).

Integration of incompletely enumerated reserves and settlements

The final step in preparing the subprovincial CSD base population is to add the estimated population of IERS that were removed from the base population up to this point. Since IERS populations are the result of an estimation model, they are not subject to the adjustments described above.

The CSD population estimates that correspond to IERS on Census Day are derived from a two-step estimation model.³³ The population on Census Day for each individual IERS is obtained by applying a linear growth from their population at the time of the previous census. The growth rate is derived from all reserves and settlements that were completely enumerated over the same period in their respective province or territory.

The model then applies a correction to account for a net undercoverage rate of IERS by calculating the national net undercoverage rate from all completely enumerated reserves and settlements. The resulting populations by age and gender for CSDs that correspond to IERS are incorporated into the other CSDs to form the complete base population for all CSDs. This base population can then be aggregated to obtain base populations for other geographical levels, such as census divisions or census metropolitan areas.

33. Statistics Canada. (2024). [Indigenous Peoples Technical Report, Census of Population, 2021](#)

Chapter 4

Births

Vital statistics for Canada have been published by the Dominion Bureau of Statistics (later Statistics Canada) since the [first annual report for vital statistics in 1921](#). Prior to 1920, vital statistics in Canada were collected in an inconsistent manner by some provincial governments. The Dominion Bureau of Statistics was created following *The Statistics Act, 1918* with an order-in-council in 1919 establishing a cooperative national vital statistics system including eight provinces.

Other provinces and territories joined the cooperative national reporting system over time. By 1956, all provinces as well as Yukon and the Northwest Territories were included in regular tabulations with Nunavut being separate from the Northwest Territories following the establishment of the territory in 1999.

In order to produce demographic estimates according to the cohort-component method, the Demographic Estimates Program (DEP) adds births to the base population as part of the calculation. For the DEP, the term birth refers to live births, excluding stillbirths.

Definitions and concepts

Data for births comes from Statistics Canada's [Canadian Vital Statistics - Birth Database \(CVSB\)](#). The registration of all live births is mandatory according to the *Vital Statistics Acts* (or equivalent legislation) of each of the provinces and territories in Canada. A live birth is a birth where, following separation from the mother, there is any evidence of life, such as breathing, beating of the heart, pulsation of the umbilical cord, or definite movement of the voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached. The DEP does not include stillbirths in the demographic estimates, which are births (after 20 weeks of gestation or with a weight of over 500 grams) that do not show any such evidence of life.

The central vital statistics registry in each province and territory provides Statistics Canada with the births data which is then used in the demographic estimates.

The conceptual universe of the Birth Database is births to Canadian resident women occurring anywhere in the world while its target population is births to Canadian resident women occurring in Canada. The actual (survey) population of the Birth Database includes births to Canadian resident women and non-resident women (visitors) occurring in Canada.

The DEP excludes births of visitors from the demographic estimates. Births and adoptions to Canadian citizens that occur abroad are included in the demographic estimates at the point that the child (or adult) enters Canada. Adoptees enter Canada through the immigration or returning emigrant components, depending on the [type of adoption process](#), while people born to Canadian citizens abroad would enter the population estimates as returning emigrants if they come to live in Canada.

The DEP counts births according to the place of residence of the mother. This is because the birth affects the population of the place of residence and not the province in which the birth occurred.

Final estimates

All levels of the demographic estimates (preliminary, updated and final) are produced using births data from the CVSB. For the final estimates, the numbers of births are taken directly from the annual births data in the CVSB. This usually happens within two to three years of the reference date, at the point at which the data in the CVSB is deemed by the DEP to be sufficiently complete.

In recent years, the duration of data collection for the CVSB has been shortened, such that fewer births may be captured at the time of each annual release of data. The data for the CVSB is revised and updated each year and the DEP includes the revised numbers until the point at which the estimates become final. The births estimates may also be revised at the time of the rebasing of the population estimates after each quinquennial census, when the final [postcensal population estimates become final intercensal](#). This would happen if the birth data from the CVSB had been further revised after they became final for the DEP.

The DEP cannot finalize the births estimates until they are considered to be sufficiently complete. Following the recent changes in release timing for the CVSB, the time between the reference date and the finalization of the births estimates may be lengthened. Data received from the CVSB are continually being reviewed by the DEP for completeness.

Data sources

The births data for the final estimates comes directly from the [Canadian Vital Statistics - Birth Database \(CVSB\)](#) which is an administrative survey that collects information on live births on an annual basis from all provincial and territorial vital statistics registries. The main form for the registration of a live birth is completed by the parents, who are responsible for filing it with the local registrar. Most provinces and territories also require physicians (or other birth attendants) to report all births.

The central vital statistics registry in each province and territory provides data from the birth registrations to Statistics Canada for inclusion in the CVSB on a continual basis. Beginning with births occurring in 2008, the provinces have been able to send data electronically to Statistics Canada via the National Routing System (NRS) although the effective date for this method of transmission varies by province. The territories send paper information which is converted to electronic format at Statistics Canada.

Subsequent changes to registrations due to errors, amendments, or omissions are transmitted to Statistics Canada when this information becomes available. However, changes received after a cut-off date are not reflected in published data.

Error detection and imputation are conducted for the CVSB following set rules, however due to the high quality of the data received, few records are imputed annually. Since the registration of births is a legal requirement in each Canadian province and territory, reporting is virtually complete. Undercoverage is thought to be minimal but is being monitored. Statistics Canada does receive late registrations, often five years after the birth, when a birth certificate is required for school registration.

Non-registration and overcoverage are minimal. Births to visitors are registered in the CVSB, but excluded in the estimates by the DEP. Any duplicate birth records are identified and removed.

Method

To create the final estimates, number of births that occurred between the date on which the base population was established and the reference date are added to the base population.

Preliminary estimates

Since the final births from the CVSB are not available at the time that the preliminary population estimates are produced (approximately three months after the reference date), the preliminary births are estimated by applying fertility rates based on the last year of final data to the population, according to the age group of the mother.

Data sources

The fertility rates by age group of the mother are produced from the last year of final data, which is supplied by the CVSB for most provinces and territories. However, preliminary and updated data for Quebec, British Columbia, and Yukon are provided by the Institut de la statistique du Québec (ISQ), BC Stats, and the Yukon Bureau of Statistics (YBS), respectively. The final estimates for all provinces and territories (including Quebec, British Columbia, and Yukon) are taken from the CVSB, when they are available and complete.

Method

The following formulas are used to generate the quarterly preliminary estimates of births at the provincial and territorial levels.

By quarter, for each province and territory, by mother's age group at the beginning of the quarter, the equation is:

Equation 4.1:

$$B_{(t,t+i)}^{a_m} = \left(\frac{f B_m^{a_m}}{f P_w^{a_w}} \right) x P_t^{a_w}$$

Where:

- $(t, t + i)$ = Interval of time between times t and $t + i$;
- $B_{(t,t+i)}$ = Number of births estimated between time t and $t + i$ to mothers m aged a ;
- $f B_m^{a_m}$ = Number of final births f , for the last corresponding quarter with final data, from mothers m aged a ;
- $f P_w^{a_w}$ = Estimate of the population of women w aged a at the beginning of the corresponding quarter for which final births estimates f are available;
- $P_t^{a_w}$ = Estimate of the population of women w aged a at the beginning of the quarter for which an estimate is required (time t);
- a = Five-year age group, for women aged 15 to 49 years old.

Then the estimate of the total number of births is calculated as follows:

Equation 4.2:

$$B_{(t,t+i)} = \sum_a B_{(t,t+i)}^{a_m}$$

Updated estimates

Until 2020, when the COVID-19 pandemic resulted in delayed reception of birth registrations by Statistics Canada which required adjustments to the typical method, all updated births estimates were calculated in the same manner as the preliminary estimates, using fertility rates applied to the population. The data from the CVSB would replace the updated estimates for all provinces and territories when they became available and the estimates would become final.

However, as the CVSB collection period has shortened, the DEP has sometimes observed that the data in the CVSB are complete for some provinces and territories and incomplete for others. In such cases, the updated birth estimates are produced by directly using the CVSB birth counts for provinces and territories where the data are considered complete. For those where the data are considered incomplete, the birth estimates are produced using fertility rates from the last year of final data, special adjustments, or a combination of both. Birth estimates become final only once the CVSB birth counts are considered complete for all provinces and territories and are used directly for all jurisdictions.

Births estimates by gender and sex at birth

The DEP currently publishes all tables according to gender, rather than sex at birth, consistent with changes introduced in the 2021 Census of Population. The data provided to the DEP from the CVSB as well as from the ISQ, have information on sex at birth and not gender. The sex at birth variable for births is used by the DEP and released as gender, consistent with current guidelines.

The final estimates of births by gender are produced using the sex at birth distribution of births in the CVSB directly. The updated and preliminary estimates by gender are produced using an average gender distribution from the past ten years of final data in the DEP (the birth estimates for the ten most recent years produced entirely using the CVSB those that are considered complete for all provinces and territories). The annual preliminary and updated data for Quebec provided by the ISQ are broken down by age and sex and that distribution is used directly by the DEP to produce preliminary and updated estimates of birth by gender for this province.

Subprovincial births estimates

For the final subprovincial estimates, the number of births at the census division (CD), census metropolitan area (CMA) and census agglomeration (CA) levels are taken directly from the CVSB. They are then adjusted to the provincial and territorial totals using [two-way raking](#) to ensure their concordance. The postal codes of individuals are geocoded using PCCF+³⁴ so that they are assigned a CD and CMA or CA geographic.

For the preliminary and updated subprovincial estimates, the preliminary and updated provincial or territorial estimates are distributed according to the most recent known subprovincial distribution, derived from the CVSB, to produce estimates by region. They are then adjusted to the provincial and territorial totals using two-way raking to ensure their consistency.

For Quebec, British Columbia and Yukon, the subprovincial preliminary and updated estimates are the total births supplied by the ISQ, BC Stats, and YBS respectively, which are distributed according to the most recent final subprovincial breakdown. The ISQ provides their subprovincial estimates by age and sex and also by subprovincial region, whereas BC Stats and the YBS provide counts for total births only for the province or territory. As with the preliminary provincial and territorial estimates, final subprovincial estimates for Quebec, British Columbia, and Yukon are taken from the CVSB when they are available and complete.

Limitations

The preliminary estimates (and some updated estimates) are based on the fertility rates by the age of the mother from the last year of final estimates, provided by the CVSB. Canada has been experiencing a generally declining fertility rate for several decades.³⁵ Thus, the longer the interval between the last year of final estimates and the preliminary estimates, the more likely that the fertility rate has changed. This may lead to an overestimation of the number of births in the preliminary or updated estimates calculated by applying fertility rates. However, an underestimation may also occur if the fertility rate were to increase.

The potential over- or underestimation of the number of preliminary or updated births may be a larger concern if there are widespread, unpredictable, societal influences on the usual patterns of change in the fertility rate.³⁶ The DEP measures the difference between the preliminary and final estimates ([known as precocity error](#)) to ensure the preliminary estimation technique continues to be appropriate.

Births are received through the NRS on a continual basis and the CVSB is updated annually with a new year of data and with historical updates to past data. It is possible that some of the data not included in the first release of data in the CVSB are non-random in distribution. This may occur due to such issues as outages in the NRS affecting only one jurisdiction or staffing shortages among one or more provincial or territorial registers. To ensure the quality and completeness of the births estimates in the DEP, all data received from the CVSB are reviewed. Methodological adjustments are applied in the case that missing data would affect the quality of the population estimates.³⁷

34. For more information on the PCCF+, please see: [Postal Code OM Conversion File Plus \(PCCF+\)](#).

35. For the crude and age-specific fertility rates in Canada, please see [Crude birth rate, age-specific fertility rates and total fertility rate \(live births\)](#).

36. For an example of the impact of the COVID-19 pandemic on fertility in Canada, please see [Fertility in Canada, 1921 to 2022](#) and [Changes in fertility intentions in response to the COVID-19 pandemic](#).

37. For an example of adjustments the DEP made to the population estimates in the context of missing data during the COVID-19 pandemic, please see [Technical Supplement: Production of Demographic Estimates for the Second Quarter of 2020 in the Context of COVID-19](#).

Chapter 5 Deaths

Introduction

Vital statistics for Canada have been published by the Dominion Bureau of Statistics (later Statistics Canada) since the [first annual report for vital statistics in 1921](#). Prior to 1920, vital statistics in Canada were collected in an inconsistent manner by some provincial governments. The Dominion Bureau of Statistics was created following *The Statistics Act*, 1918 with an order-in-council in 1919 establishing a cooperative national vital statistics system including eight provinces.

Other provinces and territories joined the cooperative national reporting system over time. By 1956, all provinces as well as Yukon and the Northwest Territories were included in regular tabulations with Nunavut being separate from the Northwest Territories following the establishment of the territory in 1999.

In order to produce demographic estimates according to the cohort-component method, the Demographic Estimates Program (DEP) subtracts deaths from the base population as part of the calculation. For the DEP, the term death excludes stillbirths.

Definitions and concepts

Data for deaths comes from Statistics Canada's [Canadian Vital Statistics - Death database](#) (CVSD). The registration of all deaths is mandatory according to the Vital Statistics Acts (or equivalent legislation) of each of the provinces and territories in Canada. A death is the permanent disappearance of all evidence of life at any time after a live birth has taken place. The DEP does not include stillbirths in the demographic estimates, which are births (after 20 weeks of gestation or with a weight of over 500 grams) that do not show any evidence of life, such as breathing, beating of the heart, pulsation of the umbilical cord, or definite movement of the voluntary muscles.

The central vital statistics registry in each province and territory provides Statistics Canada with the deaths registrations which are then used in the demographic estimates.

The conceptual universe, target universe, and actual (study) universes of the CVSD are deaths occurring in Canada of Canadian residents and any non-residents.

The DEP excludes deaths of visitors to Canada from the demographic estimates. Deaths of Canadian citizens that occur abroad are not included in the demographic estimates, as a death certificate from a Canadian province or territory is required to be included in the CVSD.

The DEP counts deaths according to the place of residence of the decedent. This is because the death affects the population of the place of residence and not the province in which the death occurred.

Final estimates

Death estimates for all levels (preliminary, updated and final) are produced using the CVSD. For the final estimates, the numbers of deaths are taken directly from the annual deaths data in the CVSD. This usually happens within two to three years of the reference date, at the point at which the data in the CVSD is deemed by the DEP to be sufficiently complete.

In recent years, the duration of data collection for the CVSD has been shortened, such that fewer deaths may be captured at the time of each annual release of data. The data for the CVSD is revised and updated each year and the DEP includes the revised numbers until the point at which the estimates become final. The deaths estimates may also be revised at the time of the rebasing of the population estimates after each quinquennial census, when the final [postcensal population estimates become of final intercensal](#) level. This would happen if the death data from the CVSD had been further revised after they became final for the DEP.

The DEP cannot finalize the deaths estimates until they are considered to be sufficiently complete. Following the recent changes in release timing for the CVSD, the time between the reference date and the finalization of the deaths estimates may be lengthened. Data received from the CVSD are continually being reviewed by the DEP for completeness.

Data sources

The deaths data for the final estimates comes directly from the [Canadian Vital Statistics - Death database](#) (CVSD) which is an administrative survey that collects information on deaths on an annual basis from all provincial and territorial vital statistics registries. The form for the registration of a death consists of personal information, supplied to the funeral director by an informant, and the medical certificate of cause of death, completed by the medical practitioner last in attendance, or by a coroner, if an inquest or enquiry was held.

The central vital statistics registry in each province and territory provides data from the death registrations to Statistics Canada for inclusion in the CVSD on a continual basis. Beginning with deaths occurring in 2008, the provinces have been able to send data electronically to Statistics Canada via the National Routing System (NRS) although the effective date for this method of transmission varies by province. The territories send paper information which is converted to electronic format at Statistics Canada.

Subsequent changes to registrations due to errors, amendments or omissions are transmitted to Statistics Canada when this information becomes available. However, changes received after a cut-off date are not reflected in published data.

Error detection and imputation are conducted for the CVSD following set rules, however due to the high quality of the data received, few records are imputed annually. Since the registration of deaths is a legal requirement in each Canadian province and territory, reporting is virtually complete. Undercoverage is thought to be minimal but is being monitored. Undercoverage may occur because of late registration, but this is not common as death registration is necessary for the legal burial or disposal of a body, as well as for settling estate matters. Late or missing registrations may also occur with unidentified bodies. By long-standing practice, the date of death for unidentified remains is defined as the date of discovery.

Undercoverage is also present for deaths of serving members of the Canadian Armed Forces. Deaths of Canadians who died overseas while serving in the Armed Forces are not included in the Statistics Canada databases because they are not registered by the provinces and territories.

Overcoverage is minimal. Deaths of non-residents in Canada are registered but are excluded from most tabulations. Duplicate death registrations are identified and removed as part of the regular processing operations on each provincial and territorial subset, as well as by additional interprovincial checks. Possible duplicate registrations are verified against microfilmed registrations or optical images, or by consulting with the provinces and territories. Age and date of birth outliers are annually reviewed for capture errors.

Method

To create the final estimates, the number of deaths that occurred between the date on which the base population was established and the reference date are subtracted from the base population.

Preliminary estimates

Since the final deaths from the CVSD are not available at the time that the preliminary demographic estimates are produced (approximately three months after the reference date), the preliminary deaths are estimated by applying mortality rates based on the last year of final data to the population, according to age group and gender.

Data sources

The mortality rates by age group and gender are produced from the last year of final data, which is supplied by the CVSD for most provinces and territories. However, preliminary and updated data for Quebec, British Columbia, and Yukon are provided by the Institut de la statistique du Québec (ISQ), BC Stats, and the Yukon Bureau of Statistics (YBS), respectively. The final estimates for all provinces and territories (including Quebec, British Columbia, and Yukon) are taken from the CVSD, when they are available and complete.

Method

The following formulas are used to generate the quarterly preliminary estimates of deaths at the provincial and territorial levels.

By quarter, for each province and territory, by age at the beginning of the quarter, for each gender, the equation is:

Equation 5.1:

$$D_{(t,t+i)}^{a,g} = \left(\frac{{}^f D^{a,g}}{{}^f P^{a,g}} \right) x P_t^{a,g}$$

Where:

$(t, t + i)$ = Interval of time between times t and $t + i$;

$D_{(t,t+i)}^{a,g}$ = Number of deaths estimated between time t and $t + i$ to people aged a and gender g ;

${}^f D^{a,g}$ = Number of final deaths, for the last corresponding quarter with final data, for people aged a and gender g ;

${}^f P^{a,g}$ = Estimate of the population aged a and gender g at the beginning of the corresponding quarter for which final deaths estimates f are available;

$P_t^{a,g}$ = Estimate of the population aged a and gender g at the beginning of the quarter for which an estimate is required (time t);

a = Five-year age group at the beginning of the quarter.

Then the estimate of the total number of deaths is calculated as follows:

Equation 5.2:

$$D_{(t,t+i)} = \sum_g \sum_a D_{(t,t+i)}^{a,g}$$

Updated estimates

Until 2020, when the COVID-19 pandemic increased the number of deaths which required adjustments to the typical method, all updated estimates were calculated in the same manner as the preliminary estimates, using mortality rates applied to the population. The data from the CVSD would replace the updated estimates for all provinces and territories when they became available and the estimates would become final.

However, as the CVSD collection period has shortened, the DEP has sometimes observed that the data in the CVSD are complete for some provinces and territories and incomplete for others. In such cases, the updated death estimates are produced by directly using the CVSD death counts for provinces and territories where the data are considered complete. For those where the data are considered incomplete, the death estimates are produced using mortality rates from the last year of final data, special adjustments, or a combination of both. Death estimates become final only once the CVSD death counts are considered complete for all provinces and territories and are used directly for all jurisdictions.

Death estimates by gender and sex at birth

The DEP currently publishes all its tables according to gender, rather than sex at birth, consistent with changes introduced in the 2021 Census of Population. The data provided to the DEP from the CVSD as well as from the ISQ, have information on sex at birth and not gender. Even though the sex at birth variable is collected, gender may in fact be recorded for an undetermined proportion of deaths among individuals whose gender differs from their sex at birth. The sex at birth variable for deaths is used by the DEP and released as gender, consistent with current guidelines.

Final estimates of deaths by age and gender are produced by using the age and sex at birth distribution of deaths in the CVSD directly. The updated and preliminary estimates by age and gender are produced using the age and gender distribution from the last two years of final data in the DEP (the death estimates for the two most recent years produced entirely using the CVSD – those that are considered complete for all provinces and territories). There are also special methodological treatments to model deaths in the youngest and oldest age groups.

Subprovincial death estimates

For the final subprovincial estimates, the number of deaths at the census division (CD), census metropolitan area (CMA) and census agglomeration (CA) levels are taken directly from the CVSD. They are then adjusted to the provincial and territorial totals using two-way raking to ensure their concordance. The postal codes of individuals are geocoded using PCCF+³⁸ so that they are assigned a CD and a CMA or a CA geographic code.

For the preliminary and updated subprovincial estimates, the preliminary and updated provincial or territorial estimates are distributed according to the most recent known subprovincial distribution, derived from the CVSD, to produce estimates by region. They are then adjusted to the provincial and territorial totals using [two-way raking](#) to ensure their consistency.

For Quebec, British Columbia and Yukon, the subprovincial preliminary and updated estimates are the total births supplied by the ISQ, BC Stats, and YBS respectively, which are distributed according to the most recent final subprovincial breakdown. The ISQ provides their subprovincial estimates by age and sex and also by subprovincial region, whereas BC Stats and the YBS provide counts for total deaths at the province or territory level only. As with the provincial and territorial estimates, final subprovincial estimates for Quebec, British Columbia, and Yukon are taken from the CVSD when they are available and complete.

Limitations

The preliminary estimates (and some updated estimates) are based on the mortality rates by age group and gender from the last year of final estimates, provided by the CVSD. However, the longer the interval between the last year of final estimates and the preliminary estimates, the more likely that the mortality rate has changed. This may lead to an underestimation or overestimation of the number of deaths in the preliminary or updated estimates calculated by applying mortality rates.

For example, mortality rates during a period with higher numbers of death (such as during the COVID-19 pandemic or the opioid crisis³⁹) used to estimate deaths three years later (after the elevated number of deaths had receded and at a time when the aftereffects of mortality displacement could occur⁴⁰), might potentially overestimate the number of deaths for the later year. Conversely, mortality rates from a non-pandemic period may not be able to accurately capture such an abrupt increase in mortality, as was the case with the COVID-19 pandemic. The DEP measures and evaluates the difference between the preliminary and final estimates ([known as precocity error](#)) to ensure the preliminary estimation technique continues to be appropriate.

Deaths are received through the NRS on a continual basis and the CVSD is updated annually with a new year of data and with historical updates to past data. It is possible that some of the data not included in the first release of data in the CVSD are non-random in distribution. This may occur due to such issues as outages in the NRS affecting only one jurisdiction or staffing shortages among one or more provincial or territorial registers. To ensure the quality and completeness of the deaths estimates in the DEP, all data received from the CVSD are reviewed. Methodological adjustments are applied in the case that missing data would affect the quality of the population estimates.⁴¹

38. For further information on the PCCF+, please see: [Postal Code OM Conversion File Plus \(PCCF+\)](#).

39. For more information about the mortality situation in Canada, please see [Mortality rates, by age group](#), [Mortality: Overview, 2014 to 2016](#), [Reductions in life expectancy directly associated with COVID-19 in 2020](#), [Provisional Deaths in Canada Dashboard](#), and [The Daily — Fall and drug overdose deaths are main contributors as accidental deaths continue to increase, 2017 to 2022](#).

40. [Excess deaths associated with covid-19 pandemic in 2020: age and sex disaggregated time series analysis in 29 high income countries - PMC](#)

41. For an example of adjustments the DEP made to the population estimates in the context of missing data during the COVID-19 pandemic, please see [Technical Supplement: Production of Demographic Estimates for the Second Quarter of 2020 in the Context of COVID-19](#).

Chapter 6 Immigrants

Canada is a country with a long tradition of immigration. In fact, the country's demographic growth is increasingly reliant on international migration since fertility has fallen below the replacement level following the end of the baby boom in the late 1960s.

Definitions and concepts

An immigrant is a person who is a permanent resident (landed immigrant). Such a person has been granted the right to live in Canada permanently by immigration authorities. Immigration to Canada has been regulated by the *Immigration and Refugee Protection Act* (IRPA) since 2002.

The process of acquiring citizenship occurs only after obtaining permanent resident status and does not alter the total number of immigrants in the country, as it represents a change in legal status rather than an addition or subtraction from the immigrant component.

Six elements must be specified to define immigrants accurately in the context of demographic estimates:

1. Adoptions through the immigration process are included.
2. When a non-permanent resident (NPR)—permit holder or asylum claimant, protected person, or other related groups—obtains permanent residence, they are removed from [the NPR component of demographic growth](#). They are then recorded as an outflow from this category, decreasing the net number of NPRs while simultaneously increasing the number of immigrants.
3. A small number of immigrants may have been born in Canada: these are the children of foreign representatives. Since they are not Canadian citizens by birth, they will be counted as immigrants only if they are granted permanent residence.
4. Children born abroad to Canadian parents who are only temporarily outside the country are not included among immigrants since they obtain Canadian citizenship at birth.
5. A landed immigrant or Canadian citizen returning to Canada after having previously emigrated from the country is considered a [returning emigrant](#) and not an immigrant.
6. People born abroad to a Canadian parent and who come to settle in Canada are not immigrants. Rather, they are included in the [returning emigrant](#) component of demographic growth if they have obtained Canadian citizenship by descent.

Note that estimates of the number of immigrants from the Demographic Estimates Program (DEP) differ from census figures. The census, conducted every five years, offers a detailed snapshot of immigrants residing in Canada, including their socio-demographic characteristics at various geographic levels, based on population-wide data collection. In contrast, the DEP is more timely and relies on administrative data to estimate the number of immigrants who have settled in the country over a given period.

Final estimates

Data source

The collection of immigration statistics in Canada has been regulated by the IRPA since 2002. This statute superseded the *Immigration Act*, which was passed in 1976 and amended more than 30 times. Immigration, Refugees and Citizenship Canada (IRCC) collects and processes permanent residents' administrative files. It then provides Statistics Canada with information from files from the Global Case Management System (GCMS). The information is used to estimate the number, province or territory of residence, age, and gender of people granted permanent resident status by the federal government on a given date.

The information sent by IRCC to Statistics Canada is transmitted monthly. It includes all permanent resident records for the previous month, along with any additions or modifications to the information previously provided.

Method

The final estimate of the number of people who become immigrants during a given period is obtained directly from IRCC data and requires no adjustments. This estimate is based on the date of permanent resident admission.

In a small number of cases, the province or territory information is not yet available. These cases are proportionally distributed among the provinces and territories based on the observed distribution of other immigrants.

Preliminary and updated estimates

The difference between preliminary, updated, and final estimates of the number of immigrants comes from the timeliness of the GCMS file used in the calculations. This file is continuously refreshed, and new totals are generated each year to update the estimates of the number of immigrants.

Estimates of the number of immigrants are preliminary or updated in the first year and final the second year.

Immigrant estimates by age and gender

Information on the age and gender of immigrants is included in the GCMS file provided by IRCC and is therefore obtained directly from that source.

However, in a small number of cases, some details are not yet available. In these instances, a proportional distribution based on the characteristics of immigrants with available information is applied.

Subprovincial immigrant estimates

Since 2011/2012,⁴² postal codes from IRCC's "mailing address file" have been used to determine subprovincial and subterritorial distributions of immigrant settlement. These postal codes are geocoded using the Postal Code^{OM} Conversion File Plus (PCCF+),⁴³ so that they are assigned a census division (CD) and census metropolitan area/ census agglomeration (CMA/CA) geographic code. If the postal code is missing, the intended municipality of residence from the GCMS is used. Finally, to ensure consistency, subprovincial estimates are then adjusted to the provincial and territorial totals using two-way raking.

Limitations

The estimates of the number of immigrants are of high quality because they are directly calculated using IRCC data, which are governed by the IRPA. However, for provincial and territorial estimates, the IRCC file indicates the intended province or territory at admission, which does not always correspond to the province or territory where the immigrant ultimately settles.

42. Estimates for periods prior to 2011/2012 in the series based on the 2021 Standard Geographical Classification were calculated using information on the immigrants' intended municipality of residence.

43. [Postal Code OM Conversion File Plus \(PCCF+\)](#)

Chapter 7

Non-permanent residents

In Canada, immigration can be either permanent or temporary. Some people come to Canada temporarily to work or study, while others arrive seeking asylum. These people are called non-permanent residents (NPRs). The number of NPRs has increased significantly over the years following the COVID-19 pandemic. Statistics Canada publishes estimates of the net number of NPRs, which is a key component of population growth, along with inflows, outflows and number of NPRs living in Canada.

Definitions and concepts

A non-permanent resident is a person from another country with a usual place of residence in Canada and who (1) has claimed refugee status (asylum claimants, protected persons and related groups) or (2) holds a work permit, a study permit, or a temporary resident permit.

Family members living with permit holders are also included, unless these family members are already Canadian citizens, landed immigrants (or permanent residents), or NPRs themselves.

Three elements must be specified to precisely define NPRs in the context of population estimates:

1. Children born in Canada to parents with NPR status are considered Canadian citizens by birth and are included in the [births](#) component of population growth.
2. NPRs who obtain permanent residence are removed from the NPR component and added to the [immigrants](#) component. Thus, a change in status reduces the size of the NPR population and increases the number of immigrants. The impact on the total population is therefore zero, as this is a transfer between two components of population growth.
3. Visitors are excluded from the NPR component, except when they are family members of a permit holder living in the same household.

Types of NPRs

As mentioned above, the two main types of NPRs are (1) asylum claimants, protected persons and related groups (AC+'s); and (2) permit holders (PHs) and their family members. These two types are distinguished by the nature of their presence in the country.

The types of NPRs are mutually exclusive and are derived in the following order of classification: AC+ then PH. Therefore, there are no AC+'s among the PHs and their family members. This implies that an AC+ can obtain a work or study permit but is still classified as AC+ in the breakdown by type of NPRs.

Asylum claimants, protected persons and related groups

AC+'s include the following three groups:

1. Asylum claimants are foreign nationals who have made a refugee claim while in Canada on a temporary basis and whose claim is pending a decision.
2. Protected persons are individuals who have made a claim in Canada and received a positive decision. For the Demographic Estimates Program (DEP), protected persons are removed from the NPR population if they obtain permanent residence.
3. Related groups include those who received a negative decision or withdrew or abandoned their claim and have not yet regularized their status or departed Canada.

When an NPR is both an AC+ and a PH, AC+ status prevails to avoid double counting. Thus, if a person holds a work or study permit while having applied for asylum, they are counted only in the AC+ category.

Permit holders and their family members

PHs and their family members are NPRs who are not AC+, but who hold a work, study or temporary resident (formerly known as “ministerial permits”) permit. This category also includes family members who are not already Canadian citizens, landed immigrants (permanent residents) or NPRs themselves.

Family members residing with certain PHs are not required to hold a work or study permit to reside in Canada. Certain family members may accompany PHs if they meet the conditions issued by Immigration, Refugees and Citizenship Canada (IRCC).

Final estimates

Data sources

The collection of statistics on temporary residents and asylum claimants in Canada has been regulated since 2002 by the *Immigration and Refugee Protection Act* (IRPA). It replaces the *Immigration Act*, which was passed in 1976 and amended more than 30 times thereafter. IRCC, along with other government departments, collects and processes the administrative records of asylum claimants. IRCC also collects and processes administrative records from work, study, and temporary resident permit holders in Canada. Information is then sent to Statistics Canada from the Global Case Management System (GCMS) files. This information is used as a basis for obtaining the number and demographic characteristics of NPRs.

The data extracted from GCMS and used by the DEP to produce the NPR estimates are as follows:

- permanent resident file
- asylum claim file
- removal file
- permit files (work, study and temporary resident)
- mailing address file.

IRCC assigns a unique client identifier (UCI) to all AC+ and PHs. This number uniquely identifies each person, regardless of the number of asylum claims or permits issued in their name. The UCI is used by Statistics Canada to produce estimates of the number of NPRs. This makes it possible to track NPRs over time and avoid double counting.

Method

Since the two types of NPRs are administratively different, estimates for each must be produced separately. Estimates of the total number of NPRs are calculated by as the sum of each NPR type as per the following formula:

Equation 7.1:

$$NPR = (AC+) + (work + study + work_study + other_NPR)$$

where

<i>NPR</i>	=	estimated number of non-permanent residents
<i>AC+</i>	=	estimated number of asylum claimants, protected persons and related groups
<i>work</i>	=	estimated number of work permit holders only
<i>study</i>	=	estimated number of study permit holders only
<i>work_study</i>	=	estimated number of work and study permit holders
<i>other_NPR</i>	=	estimated number of temporary resident permit holders, family members and Canada-Ukraine Authorization for Emergency Travel holders without permits

Asylum claimants, protected persons and related groups

Estimates of the number of AC+'s are based directly on asylum claimants' data from IRCC's GCMS.

AC+'s are counted as NPRs from the date of their asylum claim. Since asylum claims do not have an end date, AC+'s are no longer counted as NPRs if they:

- obtain permanent residency. In this situation, they are subtracted from the NPR numbers and added as immigrants.
- were deported.
- withdrew their refugee claim.
- have not contacted IRCC in 10 years. IRCC keeps information about communications with each AC+ (for a change of address for example). When an AC+ file remains inactive for more than 10 years, the DEP assumes that the person has left the country. However, this rule applies to a very limited number of cases.

The province or territory of residence of AC+'s is determined using postal code information from IRCC's "mailing address file". This file contains information on addresses provided to IRCC by AC+'s. The most recent address before the reference date is used. If this information is missing, the province or territory where the claim was made is used.

Permit holders and their family members

Estimates of the number of PHs are derived from data on work, study and temporary resident permits from IRCC's GCMS. These estimates are calculated in two main steps.

First, IRCC data are processed by Statistics Canada using the UCIs. Issuance and expiry dates are also considered. This step identifies PHs with valid work, study or temporary resident permits on the given reference date and avoids counting individuals with multiple valid permits or permanent residence more than once. PHs that hold a valid permit on the reference date are included in the estimate of the number of NPRs. Conversely, they are excluded from the NPR count when their permit expires and is not renewed. The assumption underlying this approach is that PHs leave the country when their permit ends.

Second, Statistics Canada applies several demographic adjustments to IRCC data. The adjustments allow for the assignment of a province or territory of residence to all PHs, consideration of the permit extension process, estimation of the number of family members accompanying NPRs to the country, and consideration of those who arrived under the [Canada-Ukraine Authorization for Emergency Travel \(CUAET\)](#).

Province or territory of residence

As with AC+'s, the province or territory of residence of the PH is determined using postal code information from IRCC's "mailing address file".

The province or territory of residence is not available for some PHs when these files are processed by Statistics Canada. In these situations, the province or territory is taken from the permit information.

In some cases, information from these two data sources is not available in IRCC data. These individuals are then assigned a province or territory of residence based on the type of permit they hold:

1. “Open” work permit holders can work for any employer in Canada, subject to the conditions issued by IRCC. The provincial/territorial distribution of these holders is obtained through the distribution of “open” work permit holders enumerated in the census.
2. For closed work permits, study permits and temporary resident permits, cases are distributed proportionally across provinces and territories based on the observed distribution of other work, study and temporary resident permit holders in IRCC data.

Permit extension process

Many PHs extend their stay in Canada by applying for a [permit extension](#). However, this administrative process can take time leading to PHs remaining in Canada after the end of their permit (while awaiting permit extension). IRCC data contain information on permits issued to PHs as part of an extension. However, Statistics Canada does not receive this information until the extensions are issued to the PHs.

Two subsequent steps are distinguished in the integration of these extensions into the estimates of the number of NPRs:

1. When a permit expires and no extension is identified in the various IRCC databases, the DEP removes the individual from the NPR population in accordance with the assumption that PHs leave the country when their permit ends.
2. Once a work or study extension within Canada is observed in the data, the PH is considered to have remained in the country for the entire period between the end of their initial permit and the start of their extension. Thus, during the usual revisions to NPR estimates, this person is reintegrated into the NPR population and considered to have never left Canada during this period.

Family members

Some programs allow PHs to come to Canada with family members without those family members needing permits in their names. Information on these family members who reside with the PH is not directly available in IRCC data. Therefore, their number is estimated from record linkages between IRCC data and the census.

The family relationships observed in the census make it possible to identify the family members of PHs without permits. The ratios of the number of PHs to that of their family members are calculated using census data, then applied to the estimates of the number of PHs for a given date. These ratios are kept constant until the next census. The following equation shows how this is calculated:

Equation 7.2:

$$FM_{p(t)} = \sum_{type} \left(\frac{{}^c FM_{p,type}}{{}^c PH_{p,type}} \times IRCC PH_{p,type(t)} \right)$$

where

<i>FM</i>	=	estimated number of family members of permit holders
<i>p</i>	=	province or territory
<i>t</i>	=	reference date
<i>type</i>	=	type of permit holders (work, study or temporary resident permit)
<i>C</i>	=	Census of Population
<i>PH</i>	=	estimated number of temporary resident permit holders, family members and Canada-Ukraine Authorization for Emergency Travel holders without permits

Since they do not hold work or study permits, family members of PHs are counted in the “other” category of NPR demographic statistics.

Holders of a Canada-Ukraine Authorization for Emergency Travel

As of March 17, 2022, CUAET holders present in Canada are included in the NPR estimates.

The majority of CUAET holders were issued a work or study permit upon arrival in the country. The DEP already takes these people into account in the estimates of the number of PHs. An adjustment is applied to include persons who arrived in Canada under the CUAET and do not have other permits. These individuals are included in the “other” subtype of the PH.

This adjustment is based on the [number of people who arrived in Canada under the CUAET](#), available on the IRCC’s website. The DEP then identifies work or study permit holders who hold a valid CUAET. By subtracting these holders from the total number of persons who arrived in Canada under the CUAET, the DEP obtains an estimate of the number of persons present in Canada solely under the CUAET.

CUETA holders who also have a work or study permit leave the NPR population in the same way as other permit holders, as explained previously. Since the [last arrivals in Canada under CUETA were recorded on July 31, 2024](#), this number is no longer updated. Accordingly, the DEP adjusts the estimate of those present in Canada solely under CUAET proportionally to the size of the group of work or study permit holders who simultaneously hold a CUAET.

Preliminary and updated estimates

The difference between the preliminary, updated and final NPR estimates is the timeliness of the GCMS files used for the calculations. These files are continually updated, and new tabulations are performed each year to update NPR estimates.

NPR estimates are preliminary in the first year and updated in the following year. They become definitive two to three years after the reference year.

Non-permanent residents estimates by age and gender

Asylum claimants, protected persons and related groups

The age and gender information for AC+’s is included in the GCMS file provided by IRCC and is therefore obtained directly from this source.

However, some information is not available for certain people. These cases are distributed proportionately according to the characteristics of the AC+’s for whom information is available.

Permit holders and their family members

Similar to AC+'s, information on the age and gender of PHs is available in IRCC data and is therefore used directly. Unknown cases are distributed proportionately according to the characteristics of the PHs for whom information is available.

For the age and gender of family members, the information comes from record linkages between IRCC data and the census, as explained above. The resulting age and gender distribution is then applied to the estimate of family members.

Net non-permanent residents

For the DEP, net NPRs is one of the components of demographic growth added to the base population to produce population estimates for a given date using the component method.

The net change in NPRs represents the component of demographic growth that reflects changes in the number of NPRs over a given period. It is calculated by subtracting the number of NPRs at the beginning of the period from the number at the end of the period, according to the following equation.

Equation 7.3:

$$\Delta NPR_{(t,t+i)} = NPR_{(t+i)} - NPR_t$$

where

$(t, t + i)$ = interval between the previous reference date t and the estimate date $t+i$;

$\Delta NPR_{(t,t+i)}$ = change in the NPR estimate between dates t and $t+i$;

$NPR_{(t+i)}$ = estimated number of NPRs at date $t+i$;

NPR_t = estimated number of NPRs at date t .

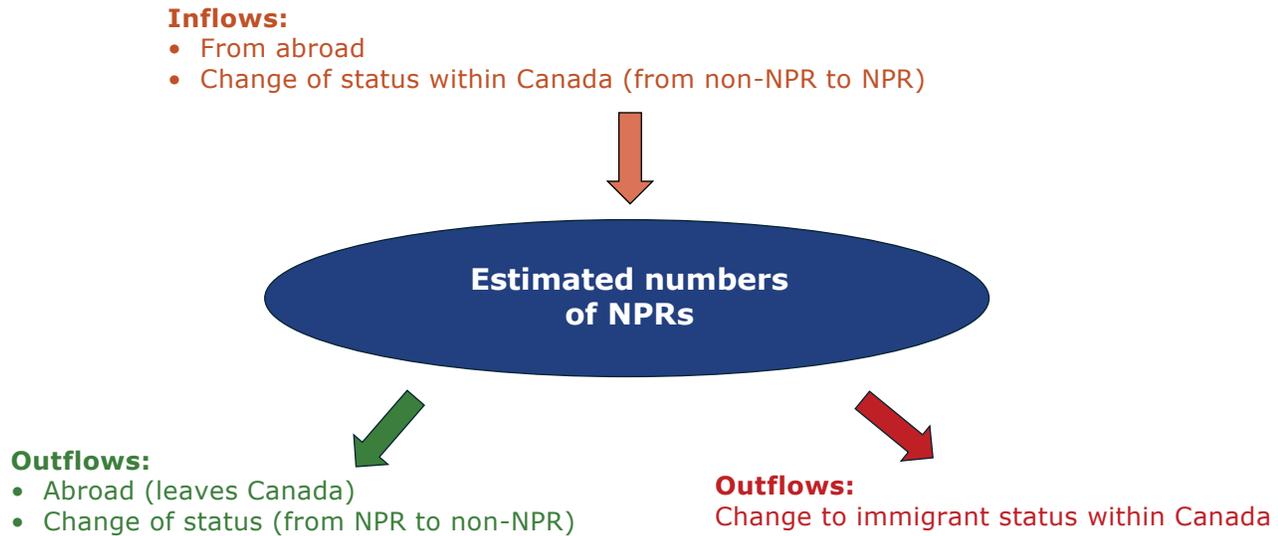
Non-permanent residents' inflows and outflows

Movements into and out of the NPR population are referred to as "flows". Individuals entering the NPR population are called *inflows*, while those who leave are called *outflows*.

These flows can occur in various contexts:

- A person coming from abroad or who previously had non-resident status in Canada (e.g., a visitor) may join the NPR population: this person is then considered an inflow.
- Conversely, an NPR who leaves the country, is deported, becomes a non-resident or obtains immigrant status leaves the NPR population: this is an outflow.

Figure 7.1
Non-permanent residents flows



Source: Statistics Canada, Centre for Demography.

As illustrated in Figure 7.1, a person coming from abroad or holding non-resident status in Canada (e.g., a visitor) may be added to the NPR population (inflow). Conversely, when a person leaves the NPR population (outflow), it is assumed that they have either left the country, become a non-resident or obtained immigrant status.

Net NPRs can also be calculated as the difference between inflows and outflows over a given period for a specific region.

Equation 7.4:

$$\Delta NPR_{(t,t+i)} = NPR_I_{(t,t+i)} - NPR_O_{(t,t+i)}$$

where

$\Delta NPR_{(t,t+i)}$ = change in the NPR estimate between dates t and $t+i$;

$NPR_I_{(t,t+i)}$ = estimated number of NPR inflows between dates t and $t+i$;

$NPR_O_{(t,t+i)}$ = estimated number of NPR outflows between dates t and $t+i$;

Consistency between quarterly and annual estimates

Quarterly and annual NPR estimates are consistent with each other. However, caution is required for data manipulation related to annual information.

- To obtain the estimate of the number of NPRs on a quarterly or annual basis, refer to the estimate for the desired reference date. Estimates of the number of NPRs should not be summed, as they represent a point-in-time estimate.
- To obtain the estimate of net NPRs on a quarterly basis, refer to the estimate for the desired reference date. However, it is possible to add the quarterly net NPRs to calculate annual growth.

Comparisons between DEP estimates of NPRs and alternative data sources

Other data sources on NPRs, temporary residents and asylum claimants are also available from Statistics Canada and IRCC. However, caution should be exercised when comparing statistics from different sources, since they are compiled in different ways and serve different purposes.

The products titled [Non-permanent residents data at Statistics Canada](#), [“Statistics on non-permanent residents at Statistics Canada,”](#) and [“How does Statistics Canada estimate the number of non-permanent residents?”](#) describe Statistics Canada’s NPR data and the various data sources that users can access.

Differences between Statistics Canada and Immigration, Refugees and Citizenship Canada data on NPRs

Statistics Canada works closely with IRCC and other federal departments and agencies to estimate the number of NPRs living in Canada. IRCC publishes statistics on temporary residents and asylum claimants. These data are used to provide information on the number of work and study permits issued in Canada or on the number of individuals with valid status in the country. They support the planning, development, delivery, monitoring, and evaluation of immigration-related programs, policies or services.

While IRCC and DEP statistics are based on the same starting data, DEP estimates are designed to examine the effects of immigration on Canada’s population, society, and economy. For example, the DEP identifies and processes individuals holding more than one valid permit at the same time to avoid double-counting and applies demographic adjustments to IRCC data to better reflect the demographic reality of this population.

Differences between NPR estimates and census figures

The Census of Population, conducted every five years, provides extensive socio-economic characteristics of NPRs at detailed geographic levels, such as municipalities. However, [some NPRs were unable to respond to the census questionnaire](#), despite Statistics Canada’s efforts to enumerate all individuals usually residing in Canada. DEP NPR estimates are published quarterly and are calculated by combining IRCC administrative data with demographic adjustments. As a result, census counts of NPRs are lower than those published through DEP.

Historical comparisons of NPR estimates

Historical comparisons of NPR estimates should be made with caution because of changes in definitions, methods and available data.

Estimates dating back to 2021 incorporate several methodological improvements, particularly regarding family members of PHs, the processing of permit extensions, and the assignment of a province or territory of residence.

Breakdowns of NPR estimates by type, and statistics on NPR inflows and outflows are available only from 2021 onward.

A series of NPR estimates is available from the third quarter of 1971 to the second quarter of 2018 and is based on information from IRCC’s former system, the Field Operations Support System. From the third quarter of 2021 onward, NPR estimates are based on the current system, the GCMS.

Subprovincial non-permanent resident estimates

Postal codes from IRCC’s “mailing address file” are used to determine the subprovincial and subterritorial distributions of NPRs. These postal codes are geocoded using the Postal Code^{OM} Conversion File Plus⁴⁴ so that they are assigned a census division and census metropolitan area/census agglomeration geographic code. When the postal code is missing, the province or territory where the asylum claim was submitted is used to determine the place of residence of AC+. For PHs and their family members, the intended municipality of residence is used for this purpose. Finally, the subprovincial distributions are applied to provincial and territorial totals using the two-dimensional iterative proportional fitting method to ensure internal consistency.

44. [Postal Code OM Conversion File Plus](#)

Limitations

Estimates of NPRs are based on IRCC data, which are governed by the IRPA. These data are of very high quality, since they are timely and cover all regular immigration. They make it possible to identify NPRs who have become immigrants or who hold more than one permit.

Since Canada does not have a population register, assumptions must be made to determine when NPRs leave the country. The DEP assumes that PHs leave the country when their permit expires if no extension has been granted. Statistics Canada has obtained [entry and exit information](#) in 2024 from the Canada Border Services Agency and is currently exploring the possibility of incorporating it into the DEP.

Information on permit extensions is available only once an extension has been approved. However, it may happen that a PH remains in the country after the expiry of their permit while awaiting a decision on their extension application. Such PHs are initially removed from the NPR population in accordance with the assumptions regarding PH departures and are subsequently added back when the extension information becomes available in IRCC data, as part of Statistics Canada's regular demographic revision process.

Demographic models are required to adjust IRCC data. The number of family members of PHs is derived from the most recent census data, assuming that the relationship between the number of PHs and their family members remains constant. The province or territory of intended destination is used for a small number of NPRs. However, this province or territory of intention does not always reflect the NPR's usual place of residence.

Chapter 8 Emigrants

Although Canada is generally perceived as a country of immigration, every year, several thousand Canadians emigrate from Canada to settle in the rest of the world. Although emigration as a demographic phenomenon is not as numerically significant when compared with immigration, the cumulative number of emigrants over time suggests that several million Canadians could be living abroad.⁴⁵ This chapter describes the methods used to estimate the number of emigrants.

Definitions and concepts

Emigrants are Canadian citizens or immigrants (permanent residents) who have left Canada to establish a long-term or short-term residence in another country involving a change in their usual place of residence.

Emigration is divided into long-term and short-term emigration for the purpose of calculating the number of emigrants. According to the United Nations, short-term migration refers to a change in the usual place of residence of 3 to 12 months, while long-term migration implies a duration of at least one year.⁴⁶

However, in the absence of data enabling a direct measurement of entries into and exits from Canada, Statistics Canada's Demographic Estimates Program (DEP) distinguishes between these two categories based on the intention behind the length of the stay. For example, people moving to the United States may be considered long-term emigrants if they acquire permanent resident status in that country, but short-term emigrants if they hold a visa.

The total number of emigrants is calculated by adding long-term emigrants and short-term emigrants. Only estimates of the number of emigrants are published.

It is important to note that a non-permanent resident (NPR) who leaves Canada is not considered an emigrant; their departure from the country is measured in the [NPR](#) component.

Long-term emigrants

Final estimates

Data sources

Unlike immigration, there is no legal obligation in Canada to maintain records for individuals leaving the country, either on a long-term or a short-term basis. Therefore, estimates of the number of emigrants must be derived through secondary sources.

The number of long-term emigrants is estimated from three administrative sources: immigration data from the [Office of Homeland Security Statistics of the U.S. Department of Homeland Security](#) for emigrants to the United States, and data from the [Canada child benefit \(CCB\)](#) and the [T1 Family File \(T1FF\)](#) for emigrants to other countries.

Immigration data from the Office of Homeland Security Statistics provide information on Canadians who have acquired permanent resident status in the United States. These data are used to estimate the number of emigrants settling in that country.

For other destination countries, estimates are based primarily on the CCB, a tax-free monthly payment made to eligible families with children under 18. These data, provided annually by the [Canada Revenue Agency \(CRA\)](#), are used to identify child emigrants, broken down by province and territory.

Estimates are also based on the T1FF, an annual tax file produced by Statistics Canada. The T1FF contains demographic and income data at subprovincial and subterritorial levels. This file is constructed from various administrative sources, such as T1 and T4 forms, as well as CCB data provided by the CRA.

45. Bérard-Chagnon, J. and Canon, L. (2022, April 13). *The Canadian diaspora: Estimating the number of Canadian citizens who live abroad* (Statistics Canada Catalogue no. 91F0015M).

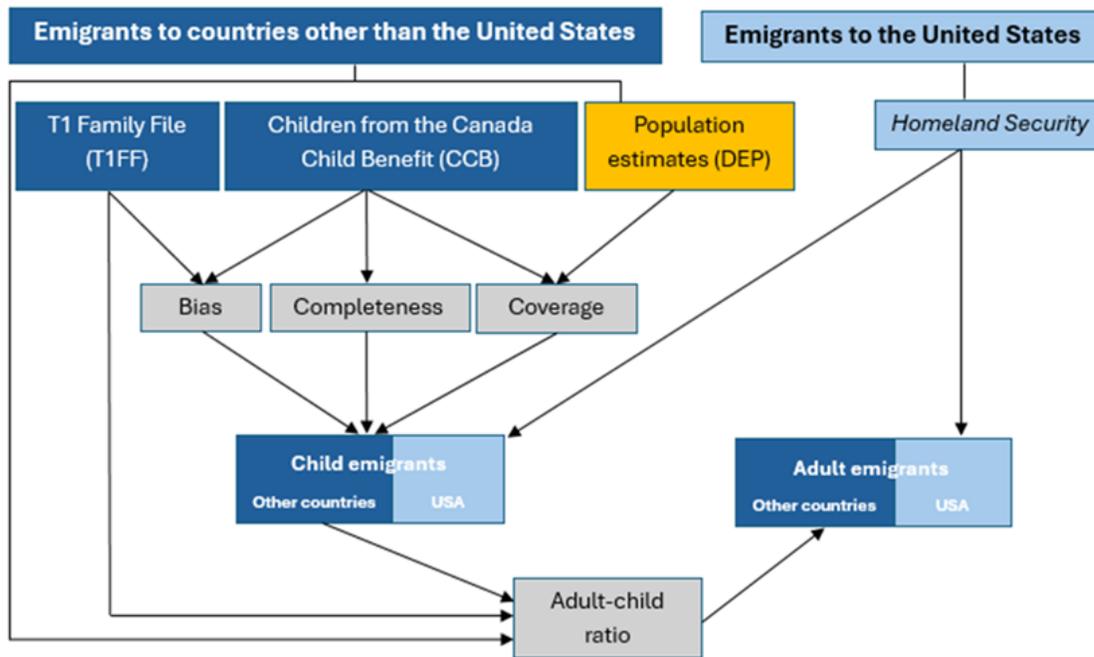
46. United Nations. (2021). *Final report on conceptual frameworks and concepts and definitions on international migration* 31 pages.

However, unlike the U.S. data, the CCB and T1FF data do not confirm whether an individual has acquired long-term residency rights in another country. It is therefore assumed that an individual who has cut ties with Canada, according to the CRA data, has established long-term residence in another country.

Method

Figure 1 shows a diagram illustrating the method used to estimate the number of long-term emigrants. The estimate is made in two parts, according to the emigrants’ destination country: the United States or other countries of the world.

Figure 8.1
Diagram of the method used to estimate the number of long-term emigrants



Source: Statistics Canada, Centre for Demography.

Estimates of the number of child emigrants must be adjusted because the CCB program is not universal and covers children only. Four adjustment factors are used to account for

1. the partial coverage of the program, that is, individuals who do not apply for the CCB or who are not eligible;⁴⁷
2. the differential propensity to emigrate between all children and those who are eligible for the CCB;
3. the incomplete CCB coverage caused by delays in receiving and processing the files of eligible children;
4. the differential propensity to emigrate between adults and children.

CCB and T1FF data are used to calculate these adjustment factors.

The number of emigrants to the United States is taken directly from immigration data provided by the Office of Homeland Security Statistics of the U.S. Department of Homeland Security.

Finally, the total number of long-term emigrants is calculated by adding the estimates for adults and children for both destinations.

Because of the logic behind the calculation methods, the methods for estimating the number of emigrants to countries other than the United States are presented first.

47. Canadian citizens, permanent residents and non-permanent residents who have been in Canada for a year and who are subject to Canadian taxation are eligible for the CCB.

Long-term child emigrants

Children emigrating to countries other than the United States

The CCB file provides the numbers of dependent children (under 18 years of age) whose parents are eligible for the program, according to the CRA definition. As mentioned, the CCB program is not universal, consequently, the data are incomplete in terms of estimating all child emigrants, hence the need for adjustments.

The first correction factor considers the partial coverage of the file resulting from the non-universality of the CCB program. The correction factor is calculated and applied to the population registered for the CCB program. The factor is the ratio of the number of children registered in the program to the number of children in the overall population estimated by the DEP for each month and each province and territory.

The second correction factor is applied to the CCB data to account for the differential propensity for emigration between children registered for the CCB program and all children. This factor is obtained on an annual basis by calculating a ratio of the emigration rate for all children (aged 0 to 17) to the rate for CCB-eligible children. This factor is calculated for each province and territory and is based on the last three available years of the T1FF. It is calculated simultaneously for all Atlantic provinces to mitigate the effect of variations attributable to the small numbers of emigrants observed for these provinces. The Canadian factor is applied to the territories for the same reason.

The third correction factor considers the partial completeness of the emigration information derived from the CCB data files because of delays in recording it. By comparing files produced two, three and four years after the reference period, it appears that the CCB files become complete enough to be used two years after the year of emigration, and that they can be considered fully complete around four years after the reference period. Since CCB data are used within this four-year timeframe, a correction factor is applied to account for this situation. The same factor is applied to the monthly data of each province and territory.

The formula to estimate child emigrants is as follows for each province and territory:

Equation 8.1:

$${}_jEM^{0-17} = {}^{CCB}{}_jEM^{0-17} \times \frac{I}{{}^{CCB}{}_j\mathfrak{R}} \times {}_jG \times D$$

where

${}_jEM^{0-17}$ = adjusted child emigrants aged 0 to 17 years from province or territory j ;

${}^{CCB}{}_jEM^{0-17}$ = number of child emigrants according to the CCB program moving from province or territory j ;

${}^{CCB}{}_j\mathfrak{R}$ = coverage rate of the CCB program for province or territory j ;

${}_jG$ = adjustment factor for the propensity of non-CCB children to emigrate (derived from the T1FF), for each province, except for the Atlantic provinces, where a single factor is calculated, and in the territories, where the Canadian factor is used;

D = adjustment factor for the incompleteness of emigration data from CCB files because of delays in recording emigration.

The factors used in Equation 8.1 are detailed in equations 8.2 to 8.4c.

First, the factor for incomplete coverage of children by the CCB program is calculated monthly as follows for each province and territory:

Equation 8.2:

$${}^{CCB}{}_j\mathfrak{R} = \left[\frac{{}^{CCB}{}_jP^{0-17}}{{}^{DEP}{}_jP^{0-17}} \right]$$

where

- ${}^{CCB}_j \mathfrak{R}$ = coverage rate of the CCB program for each province or territory j ;
- ${}^{CCB}_j P^{0-17}$ = children aged 0 to 17 years registered for the CCB program, in each province or territory j ;
- ${}^{DEP}_j P^{0-17}$ = children aged 0 to 17 years estimated by the DEP, in each province or territory j .

Secondly, the differential propensity to emigrate of CCB-registered children and non-CCB children is obtained by dividing the emigration rates for all children by the corresponding emigration rates for children registered for the CCB program, as follows for each province and territory:⁴⁸

Equation 8.3:

$${}_j G = \frac{{}^{T1FF}_j RateEM^{0-17}}{{}^{CCB_T1FF}_j RateEM^{0-17}} = \frac{\left[\frac{{}^{T1FF}_j EM^{0-17}}{{}^{T1FF}_j P^{0-17}} \right]}{\left[\frac{{}^{CCB_T1FF}_j EM^{0-17}}{{}^{CCB_T1FF}_j P^{0-17}} \right]}$$

where

- ${}_j G$ = adjustment factor for the propensity of non-CCB children to emigrate (derived from the T1FF) for each province or territory of origin j ;
- ${}^{T1FF}_j RateEM^{0-17}$ = emigration rate of all children from each province or territory j calculated from the T1FF;
- ${}^{CCB_T1FF}_j RateEM^{0-17}$ = emigration rate of CCB-registered children from each province or territory j , derived from the T1FF;
- ${}^{T1FF}_j EM^{0-17}$ = child emigrants from province or territory j , according to the T1FF;
- ${}^{T1FF}_j P^{0-17}$ = children in province or territory j , derived from the T1FF;
- ${}^{CCB_T1FF}_j EM^{0-17}$ = child emigrants registered for the CCB program from province or territory j , derived from the T1FF;
- ${}^{CCB_T1FF}_j P^{0-17}$ = CCB-registered children derived from the T1FF for province or territory j .

A three-year average of ${}_j G$ factors, based on the latest available factors, is used to mitigate the potential effects of annual factor variations.

Thirdly, completeness factors are used to compensate for the incompleteness of the CCB data file attributable to delays in registering child emigration. These factors are calculated by comparing different versions of the CCB files available over several years.

Table 8.1 illustrates the calculation of the completeness factors using fictitious figures. In this table, the production year is 2021. Therefore, the $t-3$, $t-2$ emigration year in the first column corresponds to 2018/2019 and the $t-4$, $t-3$ emigration year corresponds to 2017/2018, and so on. The next three columns of the table show the numbers of child emigrants by period between the emigration year and the year of the file used. In this fictitious example, the number of child emigrants for the emigration year $t-4$, $t-3$ from the file available two years after the emigration year is 7,900; it is 8,500 from the file available three years after the emigration year (period of three years between the emigration year and the data file year). The objective of the completeness factor is to estimate what the numbers would be for the emigration years $t-4$, $t-3$, and $t-3$, $t-2$ four years after the emigration year.

48. To mitigate the effect of volatility induced by smaller numbers, the Atlantic provinces all have the same factor, and the Canadian factor is used for the territories.

Table 8.1
Calculation of the completeness factors: An illustration for production year 2021

Year of emigration	Number of child emigrants in the CCB files after			$D_{(2,3)}$	$D_{(3,4)}$	$D_{(2,4)}$
	Two years	Three years	Four years			
t-7, t-6 (2014/2015)	6,300	6,750 ¹	7,100 ²	1.071	1.052	1.138 ⁵
t-6, t-5 (2015/2016)	6,700 ¹	7,250 ²	7,600 ³	1.082	1.048	1.142
t-5, t-4 (2016/2017)	7,200 ²	7,850 ³	8,200 ⁴	1.09	1.045	1.124
t-4, t-3 (2017/2018)	7,900 ³	8,500 ⁴	Z=8,908	1.076	...	...
t-3, t-2 (2018/2019)	7,700 ⁴	...	Y=8,740	...	...	...
Average factor (three years)	...	...	...	1.083	1.048	1.135

... not applicable

1. The diagonal data come from the 2018 CCB file.

2. The diagonal data come from the 2019 CCB file.

3. The diagonal data come from the 2020 CCB file.

4. The diagonal data come from the 2021 CCB file.

5. To obtain $D_{(2,4)}$, multiply $D_{(3,4)}$, which is one the same line, by $D_{(2,3)}$, which is on the following line. For example, the value $D_{(2,4)}$, 1.138 is equal to $D_{(3,4)}$, 1.052, multiplied by $D_{(2,3)}$, 1.082.

Source: Statistics Canada, Centre for Demography.

First, completeness factors are calculated for the previous emigration years. The completeness factors (D) in the right-hand columns are derived from the numbers on the left. $D_{(2,3)}$ is the ratio of Duration 3 to Duration 2, while $D_{(3,4)}$ is the ratio of Duration 4 to Duration 3. For example, $D_{(3,4)}$ of 1.045 for the emigration year $t-5, t-4$ comes from the ratio of 8,200 to 7,850. This factor could be used to project one year ahead from Duration 3 to Duration 4. To project two years ahead from Duration 2 to Duration 4, the factor $D_{(2,4)}$ (the last column in the table) is calculated by multiplying the two most recent factors, $D_{(2,3)}$ and $D_{(3,4)}$.

The formulas are as follows:

Equation 8.4a:

$$D_{(2,3)} = \frac{CCB EM_{(t-4,t-3)}^t}{CCB EM_{(t-4,t-3)}^{(t-1)}}$$

Equation 8.4b:

$$D_{(3,4)} = \frac{CCB EM_{(t-5,t-4)}^t}{CCB EM_{(t-5,t-4)}^{(t-1)}}$$

where

$CCB EM_{(t-x-1,t-x)}^t$ = child emigrants for the emigration year ($t-x-1, t-x$) from the CCB file in year t .

To project numbers for an emigration year that is three years earlier than the production year, the completeness factor for recording data on emigration from Duration 3 to Duration 4 (i.e., $D_{(3,4)}$) is used.

To project numbers for an emigration year that is two years earlier than the production year, then $D_{(2,4)}$ is used:

Equation 8.4c: $D = D_{(2,4)} = D_{(2,3)} \times D_{(3,4)}$

When the demographic estimates are produced, a three-year average of each of the factors $D_{(3,4)}$ and $D_{(2,4)}$ is used based on the most recent factors available. For example, using data from Table 8.1, in year t , the number of child emigrants projected for the year $t-3, t-2$ is estimated with a three-year average of the most recent $D_{(2,4)}$ factor. The average is based on the factors 1.138, 1.142 and 1.124. This average factor (1.135) is then used to multiply the number of child emigrants in year $t-3, t-2$ at Duration 2 (7,700), and the result (Y=8,740) is the number of expected CCB child emigrants in the file four years after the emigration year. The same average calculation of the

$D_{(3,4)}$ factor (1.048) is used to multiply the number of child emigrants in year $t-4$, $t-3$ at Duration 3 (8,500) to obtain the expected number of CCB child emigrants ($Z=8,908$) in the file four years after the emigration year.

Children emigrating to the United States

Data on Canadian adults and children who become immigrants in the United States are available from the U.S. Department of Homeland Security on an annual basis. These data provide the quarterly flow of immigrants to the United States emigrating from Canada. The number of child emigrants to the United States is subtracted from the estimated total number of child emigrants from CCB files to produce an estimated number of child emigrants to countries other than the United States. The calculations can be derived as follows:

Equation 8.5:

$${}^{OC}EM^{0-17} = {}^{CCB}EM^{0-17} - {}^{HS}EM^{0-17}$$

where

${}^{OC}EM^{0-17}$ = child emigrants to countries other than the United States;

${}^{CCB}EM^{0-17}$ = child emigrants based on CCB data;

${}^{HS}EM^{0-17}$ = child emigrants to the United States based on U.S. Department of Homeland Security data.

Long-term adult emigrants

Since the CCB program does not provide direct information on adult emigrants, an adjustment factor is used to estimate the number of adults emigrating to countries other than the United States. This factor is based on the emigration rate of children to other countries. Estimates for adults emigrating to the United States are taken directly from the U.S. Department of Homeland Security data.

The formula for estimating the number of adult emigrants to a country other than the United States is as follows:

Equation 8.6:

$${}^{OC}EM^{18+} = \frac{{}^{OC}EM^{0-17}}{{}^{DEP}P^{0-17}} \times {}^{DEP}P^{18+} \times F_C$$

where

${}^{OC}EM^{18+}$ = monthly number of adult emigrants to countries other than the United States;

$\frac{{}^{OC}EM^{0-17}}{{}^{DEP}P^{0-17}}$ = monthly emigration rate of children to countries other than the United States;

${}^{DEP}P^{18+}$ = estimate of the adult population at the beginning of the month;

F_C = annual ratio of the adult emigration rate to the child emigration rate to countries other than the United States.

where

The F_C factor is the ratio of the rate of adult emigration to the rate of child emigration to countries other than the United States. This ratio is taken from the T1FF,⁴⁹ and it is calculated as follows:

Equation 8.7:

$$F_C = \frac{\left[\frac{T1FF EM^{18+}}{DEP P^{18+}} \right]}{\left[\frac{T1FF EM^{0-17}}{DEP P^{0-17}} \right]}$$

where

- $T1FF EM^{18+}$ = annual number of adult emigrants to countries other than the United States, measured from the T1FF;
- $DEP P^{18+}$ = estimate of the adult population from the DEP (based on the average of the populations at the start and the end of the period);
- $T1FF EM^{0-17}$ = annual number of child emigrants to countries other than the United States, measured from the T1FF;
- $DEP P^{0-17}$ = estimate of the child population from the DEP (based on the average of the populations at the start and the end of the period).

Estimates of adult emigration to the United States come directly from the U.S. Department of Homeland Security.

Finally, the total number of adult emigrants corresponds to the following:

Equation 8.8: $EM^{18+} = OC EM^{18+} + HS EM^{18+}$

where

- EM^{18+} = adult emigrants;
- $OC EM^{18+}$ = adult emigrants to countries other than the United States;
- $HS EM^{18+}$ = adult emigrants to the United States, according to U. S. Department of Homeland Security data.

Since the data from the U.S. Department of Homeland Security do not include the province or territory of origin of Canadian emigrants, provincial and territorial estimates of adult emigration must be derived from another source. The ratio of the number of adult to child emigrants by province or territory from the T1FF is used to estimate the distribution of adult emigrants by province or territory of origin.

The provincial and territorial distribution, as well as the monthly distribution of long-term adult emigrants, is estimated in five stages: the first three are dedicated to the provincial and territorial distribution, while the last two concern the monthly distribution.

1. To estimate the number of adult emigrants by province or territory, the adult-child ratio of emigrants from the T1FF is applied to the estimate of children from the CCB:

49. Emigration is defined by the presence of a departure date on the tax return, which indicates the day when a person is no longer a resident of Canada, according to the CRA. The T1FF data identify the destination of emigration for the tax filers who provide an address in another country. Emigrant tax filers who provide a Canadian address are distributed proportionally between the United States and countries other than the United States.

Equation 8.9:

$$\text{If } {}^{T1FF}_j EM^{0-17} \text{ or } {}^{CCB}_j EM^{0-17} = 0 \text{ then } {}^W_j EM^{18+} = {}^{T1FF}_j EM^{18+}$$

else,

$${}^W_j EM^{18+} = \left[\frac{{}^{T1FF}_j EM^{18+}}{{}^{T1FF}_j EM^{0-17}} \right] \times {}^{CCB}_j EM^{0-17}$$

where

${}^{T1FF}_j EM^{18+}$ = emigrants from province or territory j aged 18 years and over from the T1FF;

${}^{T1FF}_j EM^{0-17}$ = emigrants from province or territory j aged 0 to 17 years from the T1FF;

${}^{CCB}_j EM^{0-17}$ = emigrants from province or territory j aged 0 to 17 years, estimated from the CCB;

${}^W_j EM^{18+}$ = estimate of the number of emigrants from province or territory j aged 18 years and over, which will serve to calculate the provincial and territorial distribution of adult emigrants.

To mitigate the effect of volatility induced by lower emigrant numbers in the territories, the fraction in Equation 8.9 is replaced by the national fraction for each territory. For Prince Edward Island, the fraction is replaced by the Atlantic provinces fraction for the same reason.

2. The distribution of adult emigrants by province or territory is then calculated:

Equation 8.10:

$$W_j = \frac{{}^W_j EM^{18+}}{\sum_j {}^W_j EM^{18+}}$$

where

W_j represents the weight of each province and territory and establishes the provincial and territorial distribution of adult emigrants.

3. The distribution is then applied to the total of adult emigrants (EM^{18+} from Equation 8.8):

Equation 8.11:

$${}_j EM^{18+} = EM^{18+} * W_j$$

4. The monthly distribution is then calculated for each province and territory:

Equation 8.12:

$${}_j R_m = \frac{{}^{T1FF}_j EM_m^{18+}}{\sum_{m=7(t-x-1)}^{6(t-x)} {}^{T1FF}_j EM_m^{18+}}$$

where

${}_j R_m$ represents the monthly distribution of adult emigrants for a year from July to June.

To limit the effect of volatility induced by lower emigrant numbers in the territories, the fraction in Equation 8.12 is replaced by the national fraction for each territory. For the Atlantic provinces, the fraction is replaced by a regional fraction, obtained by summing the data for the four Atlantic provinces.

5. This distribution is then applied to the total number of adult emigrants by province

(EM^{18+} from Equation 8.11):

Equation 8.13:

$${}_j EM_m^{18+} = {}'EM^{18+} * {}_j R_m$$

where

${}_j EM_m^{18+}$ represents the monthly estimates, for province or territory j , of adult emigrants aged 18 and over.

Finally, the monthly number of long-term emigrants by province or territory corresponds to the sum of the long-term child emigrants and the long-term adult emigrants.

Preliminary and updated estimates

Preliminary and updated estimates of the number of long-term emigrants follow a different method, because of the lack of sufficiently complete CCB data. This method applies to the current year, as well as to previous years, when estimates are not yet final.

Data sources

Preliminary and updated estimates of the number of long-term emigrants are calculated from the final estimates of the number of long-term emigrants and population estimates of the DEP.

Method

In the absence of sufficiently complete CCB data to estimate the number of long-term emigrants for recent years, a rate is calculated from the most recent final estimates of the number of long-term emigrants and the population at the start of the period corresponding to these estimates. In addition, the population at the start of the year to be estimated is also used. The number of long-term emigrants for recent years is estimated in four stages:

1. The rate is calculated at the Canadian level based on the final estimates of the number of long-term emigrants and the population at the beginning of the period, according to the following equation:

Equation 8.14:

$$QE_{t-x,t-x+1}^{LT} = \frac{\sum_j E_{t-x,t-x+1}^{LT}}{\sum_j P_{July t-x}}$$

where

- j = each province and territory;
- $t-x, t-x+1$ = year for which final estimates of the number of long-term emigrants are available (this period runs from July to June);
- QE^{LT} = long-term emigration rate;
- E^{LT} = final estimates of the number of long-term emigrants;
- $P_{July t-x}$ = population estimates on July 1 of year $t-x$.

2. The number of emigrants for Canada is obtained by applying the calculated rate to the population on July 1 of year t :

Equation 8.15:

$$E_{t,t+1}^{LT} = QE_{t-x,t-x+1}^{LT} * P_{July t}$$

where

- $t-x, t-x+1$ = year for which final estimates of the number of long-term emigrants are available (this period runs from July to June);
- $t, t+1$ = year for which preliminary or updated estimates of the number of long-term emigrants are produced (this period runs from July to June);
- QE^{LT} = long-term emigration rate;
- E^{LT} = estimates of the number of long-term emigrants;
- $P_{July t}$ = population estimates on July 1 of year t .

3. The national number of long-term emigrants is then broken down by province or territory according to the distribution of long-term emigrants in year $t-x, t-x+1$. The distribution follows the equation below:

Equation 8.16:

$${}_j E_{t,t+1}^{LT} = E_{t,t+1}^{LT} * \frac{{}_j E_{t-x,t-x+1}^{LT}}{\sum_j {}_j E_{t-x,t-x+1}^{LT}}$$

4. The provincial and territorial data calculated in the previous step are then broken down by month, using the monthly distribution of long-term emigrants in year $t-x, t-x+1$. The calculation is as follows:

Equation 8.17:

$${}_j E_m^{LT} = {}_j E_{t,t+1}^{LT} * \frac{{}_j E_{m \in (t-x, t-x+1)}^{LT}}{{}_j E_{t-x, t-x+1}^{LT}}$$

These steps produce estimates of the number of long-term emigrants per month, for each province and territory, based on available data.

Short-term emigrants

Some people leave Canada for a short-term stay in another country without maintaining a usual place of residence in Canada. Final estimates of the number of short-term emigrants for the intercensal period are calculated every five years when the base population for the demographic estimates is recalculated.

Final estimates

Data sources

Data from the [Census Undercoverage Study](#) (CUS; formerly known as the Reverse Record Check), the census coverage study used to estimate undercoverage, are used to estimate the number of short-term emigrants. Estimates of the number of long-term emigrants are also taken into account.

Method

The final number of short-term emigrants is estimated by month and by province or territory as follows:

1. The number of departures across Canada is estimated from the CUS; the CUS data provide an estimate of the number of people who left Canada in the short term⁵⁰ and are still outside the country on Census Day;
2. The estimated number of short-term emigrants is then broken down by province or territory,⁵¹ according to the provincial and territorial distribution of long-term emigrants;
3. Provincial and territorial estimates are disaggregated using annual rates for each of the five years of the intercensal period;
4. Monthly estimates are calculated using the monthly distribution of long-term emigrants.

Preliminary and updated estimates

CUS data are available only after the census, i.e., every five years. Preliminary and updated estimates of the number of short-term emigrants are therefore calculated using a different method.

Data sources

Preliminary and revised estimates of the number of short-term emigrants are estimated based on final estimates of the number of long-term emigrants and the DEP's population estimates.

Method

The number of short-term emigrants in recent years is estimated in four steps:

1. A rate for the entire country is derived from the quinquennial CUS data for the previous intercensal period;
2. This rate is applied to the population as of July 1 to obtain the number of short-term emigrants for year t , $t+1$ in Canada. This rate is assumed to be constant for the entire postcensal period;
3. National data are broken down by province or territory according to the distribution of long-term emigrants;

50. Emigration is defined as short-term based on the intention of returning to live in Canada and the time spent outside the country.

51. Special estimates are produced for the territories, because the CUS does not provide estimates.

4. Provincial and territorial data are further broken down by month using the monthly distribution of long-term emigrants.

Finally, the number of emigrants is calculated by adding the long-term emigrants and the short-term emigrants.

Estimates of the number of emigrants by age and gender

The distributions by province or territory, age, and gender are taken from the numbers of emigrants in the T1FF, after adjusting these data for the incomplete coverage by province or territory, age, and gender. For this step, an emigrant in the T1FF is defined as a tax filer who reported a departure date on their tax return. The coverage adjustment is calculated as follows:

Equation 8.18:

$$\text{If } \frac{T1FF}{a,g,j} P = 0 \text{ then } \frac{T1FF-adj}{a,g,j} EM = 0$$

else,

$$\frac{T1FF-adj}{a,g,j} EM = \frac{T1FF}{a,g,j} EM \times \left(\frac{\frac{DEP}{a,g,j} P}{\frac{T1FF}{a,g,j} P} \right)$$

where

- $\frac{T1FF-adj}{a,g,j} EM$ = T1FF emigrants adjusted for coverage by province or territory, age, and gender;
- $\frac{T1FF}{a,g,j} EM$ = T1FF emigrants by province or territory, age, and gender;
- $\frac{DEP}{a,g,j} P$ = DEP population estimates by province or territory, age, and gender on January 1 of the year following the T1FF year;
- $\frac{T1FF}{a,g,j} P$ = T1FF population by province or territory, age, and gender.

The adjusted emigrant numbers for the two most recent years of T1FF data are grouped by five-year age group for each province and territory and by gender. To mitigate the effect of volatility induced by lower emigrant numbers, the numbers for the four Atlantic provinces are grouped together, and national numbers are used for each of the three territories.

The numbers of emigrants are then produced by province or territory, age, and gender, using Sprague⁵² coefficients. The age of emigrants, which is their age on December 31 in the T1FF, is adjusted to their age on July 1, using formulas adapted for each age group. These numbers represent the distribution of emigrants by age and gender for each province and territory for the year from the beginning of July of year *t* to the end of June of year *t+1*. Lastly, this distribution is applied to the total number of emigrants.

Subprovincial emigrant estimates

The distribution of long-term emigrants at the subprovincial and subterritorial levels is obtained by comparing the addresses provided in the T1FF over two consecutive fiscal years. For this step, an emigrant is defined as a tax filer whose tax address is in Canada in the first year examined and abroad in the second year. The estimates are initially calculated by broad age groups (0 to 17, 18 to 24, 25 to 44, 45 to 64, and 65 and over). They are then broken down by age and gender according to the provincial or territorial distribution of emigrants. They are subsequently adjusted to provincial and territorial totals using the bidimensional iterative method to ensure consistency.

Short-term emigrants follow the same distribution as long-term emigrants.

52. Sprague's multipliers are interpolation coefficients used to subdivide data. For a detailed description of the method of Sprague's multipliers, see Shryock, Siegel et al., 1976.

Limitations

Emigration is one of the most difficult components of population growth to estimate accurately, because of the absence of a registration system at Canada's borders. Unlike immigrants and non-permanent residents, who settle in Canada by obtaining a permit issued by the federal government, the number of emigrants is calculated using indirect estimation methods.⁵³ As a result, statistics relating to emigrants generally display a higher degree of uncertainty than those for other components of population growth.

Estimates of the number of long-term emigrants are based on tax data taken from the CCB. These data use a tax concept of emigration and must be adjusted to better represent the population. Conceptual differences, adjustments and delays in obtaining data are the main sources of error.

Preliminary and updated estimates of the number of long-term emigrants are produced using the most recent final data, since CCB data are not deemed sufficiently complete at the time these estimates are calculated. Consequently, this method is based on the assumption that emigration trends remain stable for recent years. This assumption is not systematically valid and may affect the precision of the estimates.

In the absence of current information on short-term emigrants, final estimates are based on the CUS. The CUS is a sample survey that is not optimized for estimating the number of short-term emigrants. Several assumptions are made when using these data. Estimates for the intercensal period are distributed according to the distribution of long-term emigrants. Furthermore, certain additional assumptions must be made to break down national data by province or territory, and annual data by quarter. Since the CUS is available only after a census, further assumptions are required to estimate the number of short-term emigrants for the postcensal period, notably that the short-term emigration quotient is constant.

53. Bérard-Chagnon, J. (2018, December 20). [Measuring Emigration in Canada: Review of Available Data Sources and Methods](#) (Statistics Canada Catalogue no. 91F0015M).

Chapter 9

Returning emigrants

Emigration is not a permanent phenomenon. Although many people leave Canada each year to settle abroad, a certain number of them eventually choose to return to the country. This demographic phenomenon is known as returning emigration.

This chapter describes the methods used to produce estimates of the number of returning emigrants.

Definitions and concepts

Returning emigrants are Canadian citizens or immigrants (permanent residents) who have previously emigrated from Canada for a short-term or long-term and subsequently returned to live in Canada. Returning emigration also includes the immigration to Canada of citizens by birth who were born abroad.

Like emigrants, estimates of the number of returning emigrants are divided into long-term returning emigrants and short-term returning emigrants for the purpose of calculating the number of returning emigrants. The total number of returning emigrants is calculated by adding long-term returning emigrants and short-term returning emigrants. Only estimates of the number of returning emigrants are published.

Long-term returning emigrants

Final estimates

Data sources

Unlike immigration, and like emigration, returning emigration is not subject to mandatory reporting. There is no centralized system that officially records the return of people who have left Canada. Consequently, estimates of the number and characteristics of returning emigrants must be drawn from secondary sources.

As with the calculation of the number of long-term emigrants, data from the [Canada child benefit \(CCB\)](#) and the [T1 Family File \(T1FF\)](#) are used to estimate the number of long-term returning emigrants. As with emigration, determining the return to Canada depends on residency status for income tax purposes.

The CCB file indicates the number of dependent children (under 18 years of age) whose parents, who are CCB recipients, have returned to Canada after a period of emigration. These data, provided annually by the [Canada Revenue Agency \(CRA\)](#), are used to identify returning child emigrants, broken down by province or territory. A citizen or an immigrant (permanent resident) who has emigrated regains eligibility for the CCB program if they reestablish residential, economic and social ties in Canada. A long-term returning child emigrant is identified by the presence of a departure date and a return date in the CCB file, as well as by the residence status of the parents.

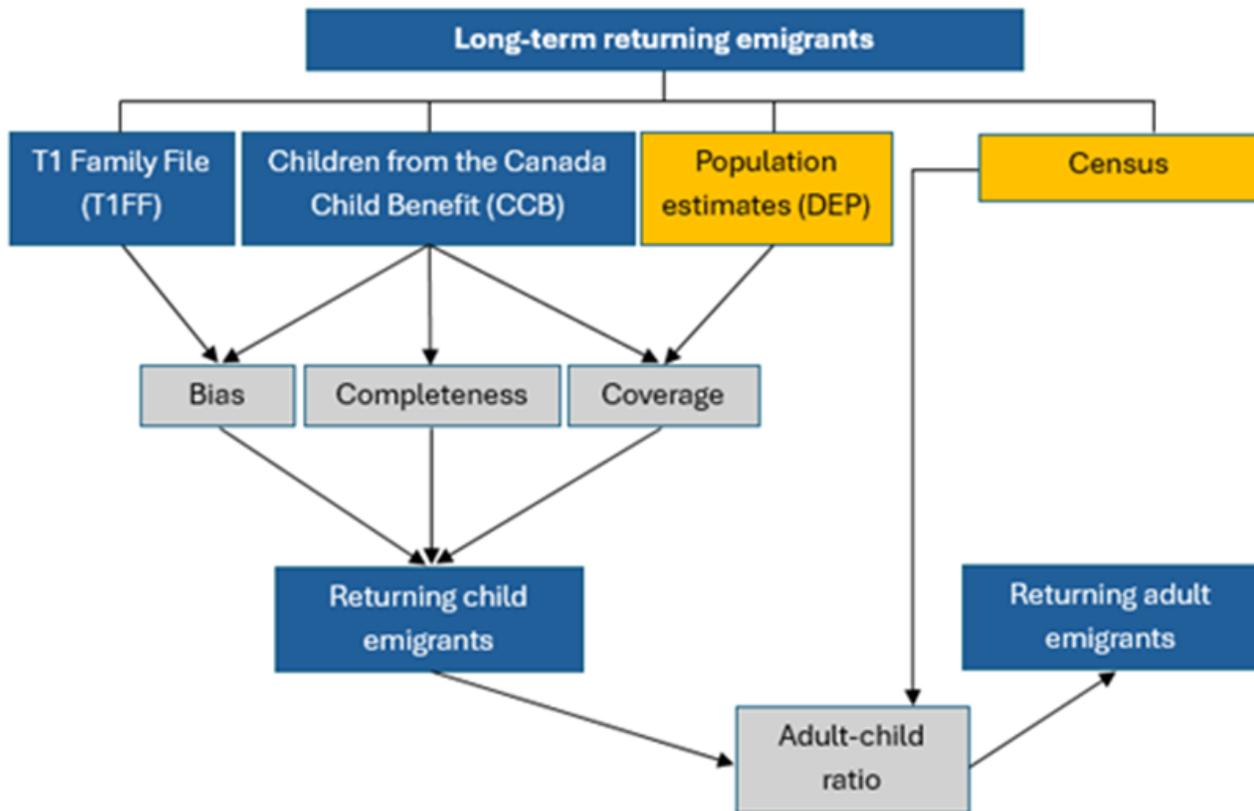
Estimates are also based on the T1FF, an annual tax file produced by Statistics Canada. The T1FF contains demographic and income data at subprovincial and subterritorial levels. This file is constructed from various administrative sources, such as T1 and T4 forms, as well as CCB data provided by the CRA.

Data from the most recent census are also used to estimate the number of long-term returning adult emigrants.

Method

Overall, the methods for estimating the number of long-term returning emigrants are fairly similar to those for the number of long-term emigrants. As with long-term emigrants, estimates of the number of children and adults who are long-term returning emigrants are calculated separately. Figure 9.1 shows a diagram illustrating the method used to estimate the number of long-term returning emigrants.

Figure 9.1
Diagram of the method for estimating the number of long-term returning emigrants



Source: Statistics Canada, Centre for Demography.

Estimates of the number of returning child emigrants must be adjusted because the CCB program is not universal and covers only eligible children. Four correction factors are used to account for:

1. the partial coverage of the program, that is, individuals who do not apply for the CCB or who are not eligible;⁵⁴
2. the differential propensity to emigrate between all children and those who are eligible for the CCB;
3. the incomplete CCB coverage caused by delays in receiving and processing the files of eligible children;
4. the ratio between the number of adults and children in the returning emigrant population.

These correction factors are calculated using data from the CCB, the T1FF and Demographic Estimates Program (DEP) estimates, as well as data from the latest census.

Finally, the total number of long-term returning emigrants is calculated by combining the estimates of adults and children.

Long-term returning child emigrants

As in the case of child emigrants, correction factors are applied to adjust CCB data.

A first factor is used to adjust CCB data to account for the partial coverage of the program, i.e., people who do not apply for benefits or who are not eligible. This factor is obtained by comparing the estimated number of children in the population with that in the CCB file (Equation 8.2).

54. Canadian citizens, permanent residents and non-permanent residents who have been in Canada for one year and who are subject to Canadian taxation are eligible for the CCB.

A second factor is applied to account for the differential propensity to emigrate between children who are eligible for the CCB and those who are not. In this case, the ratio is assumed to be the same as that used for emigrants (Equation 8.3).

Third, a completeness factor is applied to compensate for the incompleteness of the CCB file caused by delays in registering children's returning emigration. This factor is calculated using the same method as that used for emigrants but based on the numbers of returning emigrants (Equations 8.4a, 8.4b and 8.4c).

Finally, the formula mentioned previously (Equation 8.1), which is used to calculate the estimate of the number of long-term child emigrants, is also used to estimate the number of long-term returning child emigrants. In this case, the variable representing the number of child emigrants by province or territory, based on CCB data, is replaced by the one corresponding to the number of long-term child emigrants returning to Canada.

The formula used to estimate the number of long-term returning child emigrants, applied for each province and territory, is as follows:

Equation 9.1:

$${}_j RE^{0-17} = {}^{CCB}{}_j RE^{0-17} \times \frac{I}{{}^{CCB}{}_j \mathfrak{R}} \times {}_j G \times D$$

where

- ${}_j RE^{0-17}$ = adjusted returning child emigrants aged 0 to 17 years in province or territory j ;
- ${}^{CCB}{}_j RE^{0-17}$ = number of returning child emigrants according to the CCB in province or territory j ;
- ${}^{CCB}{}_j \mathfrak{R}$ = CCB coverage rate for province or territory j ;
- ${}_j G$ = adjustment factor for the propensity of non-CCB children to emigrate (derived from the T1FF data), for each province, except for the Atlantic provinces, where a single factor is calculated, and in the territories, where the Canadian factor is used;
- D = adjustment factor for the incompleteness of returning emigration data from CCB files because of delays in recording returning emigration.

Long-term returning adult emigrants

The number of adults returning to Canada after long-term emigration can be estimated indirectly from census data. However, the census cannot be directly used to provide the number of adult emigrants returning to Canada, because it is not timely enough for the purposes of demographic estimates. The number of adults who are long-term returning emigrants is therefore estimated using an adult-child ratio calculated from the census and applied to the estimates of the number of children who are long-term returning emigrants obtained through the methods presented earlier. This ratio is calculated as follows, based on the latest available census:

Equation 9.2:

$$\tau^{RE} = \frac{{}^C RE^{18+}}{{}^C RE^{0-17}}$$

where

- τ^{RE} = ratio between the number of adults and children in the returning emigrant population;
- ${}^C RE^{18+}$ = number of returning adult emigrants according to census data;
- ${}^C RE^{0-17}$ = number of returning child emigrants according to census data.

The number of long-term returning adult emigrants is estimated by multiplying the estimate of long-term returning child emigrants, obtained from the adjusted CCB data, by the adult-child ratio defined in Equation 9.2.

Equation 9.3:

$${}_j RE^{18+} = {}^{CCB} RE^{0-17} \times \tau^{RE}$$

where

- ${}_j RE^{18+}$ = estimated monthly number of returning adult emigrants for province or territory j ;
- ${}^{CCB} RE^{0-17}$ = estimate of the monthly number of returning child emigrants according to CCB data for province or territory j ;
- τ^{RE} = adult-child ratio for the long-term returning emigrant population.

Subsequently, the number of adults is added to the number of children for each province and territory.

The national monthly distribution, corresponding to the sum of the provincial and territorial data, is then applied uniformly to each province and territory. The underlying assumption is that national seasonality better reflects variations in returning emigration than the specific seasonality of each province or territory.

Equation 9.4:

$${}_j RE'_m = \frac{\sum_j {}_j RE_m}{\sum_m \sum_j {}_j RE_m} * \sum_m {}_j RE_m$$

where

- ${}_j RE'_m$ = estimate of the adjusted monthly number of returning emigrants for province or territory j ;
- ${}_j RE_m$ = estimated monthly number of returning emigrants for province or territory j .

These steps produce estimates of the number of long-term returning emigrants per month, for each province and territory, based on available data.

Preliminary and updated estimates

Preliminary and updated estimates of the number of long-term returning emigrants follow a different method, because of the lack of sufficiently complete CCB data. This method applies to the current year, as well as to previous years, when estimates are not yet final.

Data sources

Preliminary and updated estimates of the number of long-term returning emigrants are derived from the final estimates of long-term returning emigrants and the population estimates from the DEP.

Method

Once again, the preliminary and updated methods for estimating the number of long-term returning emigrants are similar to those for long-term emigrants. In the absence of sufficiently complete CCB data to estimate the number of long-term returning emigrants for recent years, a rate is calculated using the most recent final estimates of long-term returning emigrants and the population at the beginning of the period corresponding to these estimates. In addition, the population at the beginning of the year to be estimated is also used. The number of long-term returning emigrants for recent years is estimated in four steps:

1. The rate is calculated at the Canadian level based on the final estimates of the number of long-term returning emigrants and the population at the beginning of the period. This rate is calculated with the same method used for emigrants but based on the number of returning emigrants ([Equation 8.14](#));
2. The calculated rate is applied to the population on July 1 of year t to obtain an estimate of the number of returning emigrants at the national level ([Equation 8.15](#));

3. The national number of long-term returning emigrants is then distributed across provinces and territories based on the distribution of long-term returning emigrants from year $t-x$, $t-x+1$. This distribution follows [Equation 8.16](#), which mirrors the methodology used for emigrants, adapted for returning emigrants;
4. The provincial and territorial figures calculated in the previous step are then broken down by month, using the monthly distribution of long-term returning emigrants from year $t-x$, $t-x+1$, according to [Equation 8.17](#).

These steps produce monthly estimates of the number of long-term returning emigrants for each province and territory, based on available data.

Short-term returning emigrants

Some people leave Canada for a short-term stay in another country without maintaining a usual place of residence in Canada. Final estimates of the number of short-term returning emigrants for the intercensal period are calculated every five years when the base population for the demographic estimates is recalculated.

Final estimates

Data sources

The estimates of the number of short-term returning emigrants are derived from two sources: the DEP estimates of long-term returning emigrants and information on [the place of residence five years prior to the census](#). The census provides the number of Canadian citizens and landed immigrants living outside Canada at the time of the previous census and who returned to the country during the intercensal period.

The census data are assumed to capture all cases of returning emigration, while the DEP data cover only long-term returning emigrants.

Method

The monthly number of short-term returning emigrants is estimated by province or territory as follows:

1. Census data on the place of residence five years prior (variable MOB5) are used to estimate the number of short-term returning emigrants. However, since this variable does not cover children under the age of 5 years, an adjustment is made to ensure full representation of the population. This adjustment is carried out using MOB5 and the age and sex distribution of long-term returning emigrants from the DEP. A ratio is calculated using the number of long-term returning emigrants under 5 years and those aged 5 years and over:

Equation 9.5:

$$R_{\beta}^{0-4} = \frac{\sum_{a=0}^4 \text{dist}_a ER_{\beta}^{LT}}{\sum_{a=5}^{120+} \text{dist}_a ER_{\beta}^{LT}}$$

where

- R_{β}^{0-4} = adjustment to account for long-term returning emigrants under 5 years;
- β = census year for which data are available on MOB5 returning emigrants, as well as the age and gender distribution of long-term returning emigrants;
- $\text{dist}_a ER_{\beta}^{LT}$ = distribution of long-term returning emigrants from the DEP;
- a = age.

2. The number of short-term returning emigrants under 5 years is obtained by applying the calculated ratio to the MOB5 returning emigrant data:

Equation 9.6:

$${}^{MOB5}ER_{\beta}^{0-4} = R_{\beta}^{0-4} * {}^{MOB5}ER_{\beta}$$

where

${}^{MOB5}ER_{\beta}^{0-4}$ = estimated number of returning emigrants under 5 years;

${}^{MOB5}ER_{\beta}$ = number of returning emigrants from the census.

- The estimate from the second step is added to the MOB5 returning emigrants to obtain the adjusted data covering all ages:

Equation 9.7:

$${}^{MOB5}ER_{\beta}^{Total} = {}^{MOB5}ER_{\beta} + {}^{MOB5}ER_{\beta}^{0-4}$$

where

${}^{MOB5}ER_{\beta}^{Total}$ = number of returning emigrants from the census.

- The number of short-term returning emigrants is calculated by subtracting the estimates of long-term returning emigrants from the adjusted MOB5 figures. This calculation is performed only at the national level.

Equation 9.8:

$$ER_{\beta-5,\beta}^{ST} = {}^{MOB5}ER_{\beta}^{Total} - \sum_{j=TNL}^{Nt} ER_{\beta-5,\beta}^{LT}$$

where

$ER_{\beta-5,\beta}^{ST}$ = number of short-term returning emigrants for the intercensal period.

- The national number of short-term returning emigrants is then distributed across the provinces and territories according to the distribution of short-term emigrants. This distribution is based on the assumption that short-term emigrants return to settle in the same province or territory as they left. The distribution follows the equation below:

Equation 9.9:

$${}_j ER_{\beta-5,\beta}^{ST} = ER_{\beta-5,\beta}^{ST} * \frac{{}_j E_{\beta-5,\beta}^{ST}}{\sum_{j=TNL}^{Nt} {}_j E_{\beta-5,\beta}^{ST}}$$

where

m = $m \in [\beta-5, \beta]$ month of the five-year period, from July of year $\beta-5$ to June of year β .

- The provincial and territorial data calculated in the previous step are then broken down by month using the monthly distribution of short-term emigrants. The calculation is as follows:

Equation 9.10:

$${}_j ER_m^{ST} = {}_j ER_{\beta-5, \beta}^{ST} * \frac{{}_j E_m^{ST}}{\sum_m {}_j E_m^{ST}}$$

where

$m = m \in [\beta-5, \beta]$ month of the five-year period, from July of year $\beta-5$ to June of year β .

These steps produce monthly estimates of the number of short-term returning emigrants, for each province and territory, based on available data.

Preliminary and updated estimates

Data sources

Preliminary and updated estimates of the number of short-term emigrants are derived from the estimates of short-term emigrants and the population estimates from the DEP.

Method

It is possible to estimate the number of short-term returning emigrants only for the intercensal period preceding the most recent census, because the method relies on census data. The provisional and updated estimation methods for the number of short-term returning emigrants are similar to those used for short-term emigration. The number of short-term returning emigrants for recent years is estimated in four steps:

1. A rate for the entire country is derived from the five-year data on short-term returning emigrants;
2. This rate is applied to the population as of July 1 to obtain the number of short-term returning emigrants for year $t, t+1$ in Canada;
3. The national data are broken down by province or territory according to the distribution of short-term emigrants;
4. The provincial and territorial data are broken down by month using the monthly distribution of short-term emigration.

Finally, the number of returning emigrants is calculated by adding the number of long-term returning emigrants and the number of short-term returning emigrants.

Estimates of the number of returning emigrants by age and gender

The age and gender distribution of long-term returning emigrants is based on census data. The characteristics of long-term returning emigrants are derived from [one-year mobility](#) data, after excluding non-permanent residents and recent immigrants. As of 2021/2022, the age and gender distributions used are based on the 2021 Census.

For short-term returning emigrants, the age and gender distribution is based on that of short-term emigrants.

Subprovincial estimates of returning emigrants

The distribution of long-term returning emigrants at the subprovincial and subterritorial levels is obtained by comparing the addresses provided in the T1FF over two consecutive fiscal years. For this step, a returning emigrant is defined as a tax filer whose tax address is abroad in the first year examined and in Canada in the second year, and who also appears in a historical file containing all social insurance numbers issued in Canada. This method makes it possible to identify a person as a returning emigrant even if they left the country many years earlier.

Estimates are initially calculated by broad age group (0 to 17, 18 to 24, 25 to 44, 45 to 64, and 65 and over). They are then broken down by age and gender according to the provincial or territorial distribution of long-term returning emigrants. These estimates are subsequently adjusted to provincial and territorial totals using two-way raking to ensure consistency.

Short-term returning emigrants follow the same subprovincial distribution as short-term emigrants.

Limitations

Returning emigration is one of the most difficult components of population growth to estimate accurately between censuses, because of the absence of a registration system at Canada's borders. Unlike immigrants and non-permanent residents, who settle in Canada by obtaining a permit issued by the federal government, the number of returning emigrants is calculated using indirect estimation methods, similar to those used to estimate the number of emigrants. As a result, statistics relating to returning emigrants generally display a higher degree of uncertainty than those for other components of population growth.

As with emigration, estimates of the number of long-term returning emigrants are based on tax data taken from the CCB. These data use a tax concept of returning emigration and must be adjusted to better represent the population. Conceptual differences, adjustments and delays in obtaining data are the main sources of error.

Preliminary and updated estimates of the number of long-term returning emigrants are produced using the most recent final data, since CCB data are not deemed sufficiently complete at the time these estimates are calculated. Consequently, this method is based on the assumption that returning emigration trends remain stable for recent years. This assumption is not systematically valid and may affect the precision of the estimates.

In the absence of current information on short-term returning emigrants, final estimates are based on the estimates of the number of long-term returning emigrants from the DEP and information on the place of residence five years prior to the census for the previous intercensal period. This approach is based on several assumptions, notably that the census captures all cases of returning emigration. Estimates for the intercensal period are distributed according to the distribution of short-term emigrants. Furthermore, certain additional assumptions must be made to break down national data by province or territory, and annual data by quarter. Since census data are available every five years, further assumptions are required to estimate the number of short-term returning emigrants for the postcensal period, notably that the short-term returning emigration rate is constant.

Net emigration

The net emigration figure enables a consistent comparison of emigration components over time. It corresponds to the difference between emigrants and returning emigrants. Before July 2016, the calculation of net emigration also included net temporary emigration: emigrants + net temporary emigration - returning emigrants.

Estimates of the number of emigrants and returning emigrants have been revised since July 2016. Prior to this date, short-term emigrants and short-term returning emigrants were included in the "net temporary emigration" component. After this date, they have been included in the emigrants and returning emigrants components, respectively, according to the methodology described above and in the previous chapter. As a result of this change, the net temporary emigration component is no longer calculated from July 2016.

Net temporary emigration

For more information on the methodology of this component, consult the previous version of this document (91-528-X): [Chapter 6 Emigrants, net temporary emigrants and returning emigrants](#).

Chapter 10

Interprovincial migration

Interprovincial migration represents movement between provinces or territories involving a change in the usual place of residence. Intraprovincial migration also involves a change in usual place of residence, but these movements occur within the same province or territory. The term internal migration may refer to either interprovincial migration or intraprovincial migration, or both. This chapter focuses on the interprovincial migration component. For information on intraprovincial migration, see [Chapter 11](#).

There is no provision for recording interprovincial migration in Canada. Consequently, this component of demographic growth is estimated using administrative data. The methods used to prepare estimates of interprovincial migration will be discussed in this chapter.

Definitions and concepts

Interprovincial migration is the movement of persons from one province or territory to another, involving a change to their usual place of residence. These movements are measured by comparing the place of residence at the beginning and end of the measurement period.

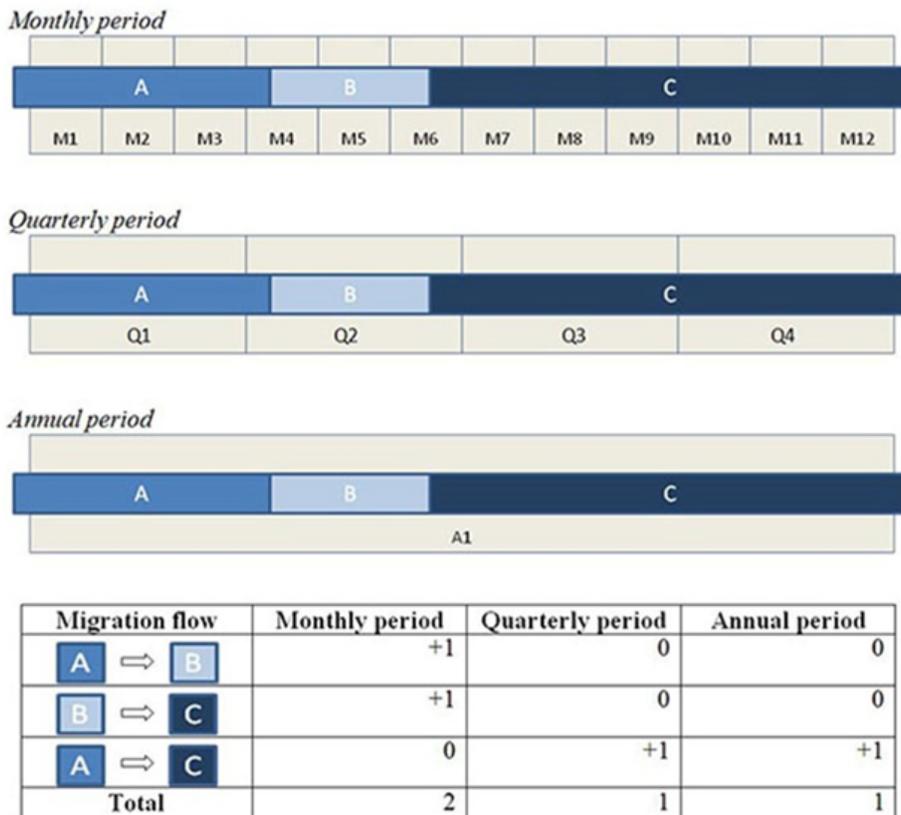
Canada Revenue Agency (CRA) provides Statistics Canada with data from the Canada child benefit (CCB) program and personal income tax returns (such as T1 and T4), which are used to estimate interprovincial migration. Monthly, quarterly and annual interprovincial migration estimates are produced using these sources.

Since 1976, personal income tax records have become the official data source for final interprovincial migration estimates. The population covered by tax data is more comprehensive than that of the CCB; in general, interprovincial migration estimates based on tax data are considered to be of higher quality than those produced using data from the CCB. However, tax data are not timely enough for use in preliminary estimates. Statistics Canada receives tax data only after annual processing, compared to CCB data which are available on a monthly basis. Therefore, final estimates are calculated annually using the T1 Family File (T1FF), while preliminary estimates⁵⁵ are calculated using CCB data.

Interprovincial migration is a unique demographic phenomenon, in that it is closely tied to the measurement period. In fact, as a result of return migration and multiple migrations, the number of migrants may differ substantially depending on the duration of the measurement period. The following diagram illustrates this situation using a case of multiple migration.

55. Unless otherwise noted, the term “preliminary” includes both preliminary and updated estimates when it refers to components.

Figure 10.1
Mock migration flow of a migrant starting the year in province A and ending it in province C, by measurement period



Source: Statistics Canada, Centre for Demography.

Even though the migrant moves twice in the same year, only one move is recorded at the annual level (A to C). As well, since both moves occur in the second quarter, only one move is recorded at the quarterly level (A to C). Lastly, since the moves occur in the fourth and sixth months, two moves are recorded at the monthly level (A to B and B to C). The result is different migration flows depending on the measurement period.

Since interprovincial migration estimates are calculated for the month, quarter and year, the number of migrants must be calculated for each measurement period. Although the number of migrants may differ, net interprovincial migration⁵⁶ must be identical for each measurement period. For example, annual net migration in the figure above is -1 for A, 0 for B and +1 for C regardless of whether it is calculated using monthly periods or quarterly periods. However, given the nature of the administrative data and the fact that some individuals are absent at the beginning and end of each period, an adjustment must be made to ensure that the net migration is identical.

Final interprovincial migration estimates

Data sources

The T1 Family File (T1FF) is an annual administrative tax file processed by Statistics Canada. The T1FF contains income and demographic information of tax filers and their dependants for subprovincial geographic areas. The file is created using various administrative data including those provided by Canada Revenue Agency, such as the T1, T4, and the Canada Child Benefit.

56. Net interprovincial migration is the difference between in-migrants and out-migrants for a given province or territory.

The Canada Child Benefit (CCB) is a tax-free monthly payment made to eligible families with children under 18 years of age. Information from the Canada Child Benefit (CCB) program is provided by the Canada Revenue Agency on a monthly basis, and the data is used to identify migration of children.

Estimation methodology

Final estimates of interprovincial migration are produced using the T1FF. By comparing the place of residence at the time of filing, it is possible to identify for those persons who file returns for two consecutive years, those who move, their place of origin and their destination. The development of migration data involves four main steps:

1. geocoding of tax records;
2. estimation of non-filing dependants of tax filers, by age group and gender;
3. identification of migrant tax filers by age group and gender;
4. adjustment for the population not covered by the T1FF.

The four steps of the estimation methodology are described below.

Step 1 – Geocoding

The migration data developed from the taxation records are estimates of migration flows between census divisions (CDs) or census metropolitan areas (CMAs) and census agglomerations (CAs). The geographic coding of CDs, CMAs, and CAs on the tax records is done primarily on the basis of the postal code, which is a part of the mailing address. About 99% of all tax records are filed with a postal code, or are assigned one, based on the filer's address by matching the address to a file similar to the Postal Code Directory from Canada Post. As the tax return is usually submitted several months after the end of the tax year, the postal codes correspond to those existing in the spring of the year following the tax year.

Step 2 – Estimation of dependants

Since the tax records source file has no direct information on the number and characteristics of non-filing dependants, this information must be imputed. The estimation of tax filers' dependants is based on the T1FF. Families are created by linking all filing family members together, using spousal social insurance numbers, marital status, and matched addresses. Non-filing spouse is imputed whenever a filer has declared himself or herself married but was not linked to a filing spouse. Children are imputed based on CCB data, which carry the social insurance number of the parent receiving the benefit, as well as from previous T1FF. Newborns are added to tax filer records from Statistics Canada's Birth Database.

The family data from the T1FF are then used to create a file of individual tax filers for the migration system. The migration file contains information for each tax filer and assigns dependants to each tax filer based on the number of filers in the family, and the number of dependants. If only one parent in the family has filed a tax return, then all dependants, including the spouse, if one exists, are added to the tax filer's record. If both parents filed tax returns, and their family record contained dependant children, then each tax filer would receive half the count of dependants.

Step 3 – Identifying migrant tax filers

After assigning the geographic codes and non-filing dependants to each tax filer, records for two consecutive years are matched by social insurance number. Only records of tax filers who are present in both years are retained. Migrant tax filers are identified by comparing current and previous geography codes (CDs, CMAs, or CAs). Thus, it is only possible to determine migrant status for those who file in two consecutive years. The identification of migrants is based on their address at the time of filing, and thus the migration period is not precisely one year, but it is assumed to be close. The assumed reference period is around April to April, of the year following each tax year. However, in Statistics Canada's Demographic Estimates Program, the given estimates cover the period from July to June. Tax filers' non-filing dependants are assumed to have the same migration behaviour as that of the filers to whom they are assigned.

Step 4 – Coverage adjustment factor

The final step in the estimation process is an adjustment for coverage, performed at the CD, CMA, and CA level for gender and specific age groups. This adjustment is required to estimate those migrants who did not file two consecutive personal income tax returns, which involves the calculation of coverage adjustment factors.

The coverage adjustment factors are calculated by dividing the population estimates from the Demographic Estimates Program of a given CD, CMA or CA with the T1FF counts, for each gender and age group.

The adjustment factors are applied to the counts of interprovincial migrants derived in Step 3 to obtain an estimate of total migrants. The basic assumption is that the population not covered by the taxation system has the same rate of migration as those for whom it can be measured.

The total migration estimates at the CD level are then aggregated to obtain the provincial/territorial estimates of in-migrants, out-migrants, and net migrants.

Final interprovincial migration estimates by age and gender

Final interprovincial migration estimates are derived from the T1FF file consisting of age and gender, as well as the province/territory of origin and destination. Unlike previously, where the estimates by single year of age were derived using a combination of T1FF, Census and Sprague's multipliers, the data from T1FF is used directly instead. Please note that estimates from 2021/2022 onwards are based on this new method.

For details on the previous methodology, please refer to the 2015 edition of this publication.

Aligning estimates from different measurement periods

Final annual estimates are obtained directly from T1FF data. However, since these data are annual, models must be used to calculate monthly and quarterly final estimates. As well, these estimates must be adjusted to align the net interprovincial migration of the different measurement periods for which estimates are derived.

As is the case with preliminary estimates (see section [Preliminary interprovincial migration estimates](#)), matrix representations are used for final estimates. A matrix is used to represent interprovincial migration between 13 provinces and territories of origin (denoted by j) and 13 destination provinces and territories (denoted by k). Each item (j,k) of the matrix represents both the number of out-migrants from province or territory of origin j and the number of in-migrants to destination province or territory k .

Monthly estimates

Monthly interprovincial migration estimates are derived as follows.

First, a matrix containing the sum of the monthly number of migrants in the 12 months of the year is created using the annual matrix of the T1FF and the preliminary estimates derived from CCB data.

For each province or territory of origin j and destination province or territory k , item (j,k) of the matrix is calculated as follows:

Equation 10.1:

$${}^D_{j,k}SM_{t,t+11} = {}^P_{j,k}SM_{t,t+11}^{**} \times \frac{{}^D_{j,k}A_{t,t+11}}{{}^P_{j,k}A_{t,t+11}}$$

where

${}^D_{j,k}SM_{t,t+11}$	=	sum of the final (D) monthly number of migrants from month t to month $t+11$ for the province or territory of origin j , and the destination province or territory k ;
${}^P_{j,k}SM_{t,t+11}^{**}$	=	sum of the preliminary (P) monthly number of migrants from month t to month $t+11$ for the province or territory of origin j , and the destination province or territory k aligned with preliminary annual net numbers;
${}^D_{j,k}A_{t,t+11}$	=	final (D) annual number of migrants for the province or territory of origin j , and the destination province or territory k ; and

${}^P A_{j,k,t,t+11}$ = preliminary (*P*) annual number of migrants for the province or territory of origin *j*, and the destination province or territory *k*.

An adjustment is then applied to the matrix so that the sum of monthly net interprovincial migrants matches that of the annual matrix.

The adjustment involves calculating the difference between the net numbers of the two matrices for each combination of origin and destination:

Equation 10.2:

$${}^D \Delta_{j,k,t,t+11} = \left({}^D SM_{k,j,t,t+11} - {}^D SM_{j,k,t,t+11} \right) - \left({}^D A_{k,j,t,t+11} - {}^D A_{j,k,t,t+11} \right)$$

where

${}^D \Delta_{j,k,t,t+11}$ = difference in number of migrants between the final (*D*) matrix resulting from the sum of the monthly number of migrants from month *t* to month *t+11* and the final annual matrix for the province or territory of origin *j*, and the destination province or territory *k*.

The differences calculated above are then used to change the number of migrants to create a new matrix in which the net numbers match those of the annual migration matrix.

Each item (*j,k*) of the adjusted matrix is obtained as follows:

Equation 10.3:

$${}^D SM_{j,k,t,t+11}^* = {}^D SM_{j,k,t,t+11} + {}^D \Delta_{j,k,t,t+11} \times \frac{{}^D SM_{j,k,t,t+11}}{{}^D SM_{j,k,t,t+11} + {}^D SM_{k,j,t,t+11}}$$

where

${}^D SM_{j,k,t,t+11}^*$ = sum of the final (*D*) monthly number of migrants adjusted so that net numbers match those of the annual matrix for the province or territory of origin *j*, and the destination province or territory *k*.

Various adjustments are made to matrix ${}^D SM_{j,k,t,t+11}^*$ to avoid negative values or division by zero.

Lastly, for each of the 12 months, the adjusted monthly interprovincial migration matrix is derived using the matrix resulting from Equation 10.3 and preliminary monthly estimates derived from the CCB.

Equation 10.4:

$${}^D M_{j,k,t}^* = {}^P M_{j,k,t}^{**} \times \frac{{}^D SM_{j,k,t,t+11}}{{}^P SM_{j,k,t,t+11}^{**}}$$

where

${}^D M_{j,k,t}^*$ = final (*D*) monthly number of migrants in month *t* adjusted so that net numbers match the annual net numbers for the province or territory of origin *j*, and the destination province or territory *k*; and

${}^P M_{j,k,t}^{**}$ = preliminary (*P*) monthly number of migrants in month *t* adjusted so that preliminary net numbers match the preliminary annual net numbers for the province or territory of origin *j*, and the destination province or territory *k*.

This matrix contains the final monthly numbers of migrants adjusted so that the sum of the net numbers matches that of the annual matrix.

Quarterly estimates

When monthly interprovincial migration estimates are produced, quarterly migration estimates can be derived.

First, final quarterly matrices must be derived using information from preliminary matrices and final monthly matrices for the three months in each quarter produced above.

For each province or territory of origin j and destination province or territory k , each item (j,k) of the quarterly migration matrix is calculated as follows:

Equation 10.5:

$${}^D Q_{j,k,t,t+2} = {}^P Q_{j,k,t,t+2}^* \times \frac{{}^D SM_{j,k,t,t+2}^*}{{}^P SM_{j,k,t,t+2}^{**}}$$

where

$${}^D Q_{j,k,t,t+2} = \text{final (D) quarterly number of migrants from month } t \text{ to month } t+2 \text{ for the province or territory of origin } j \text{ and the destination province or territory } k; \text{ and}$$

$${}^P Q_{j,k,t,t+2}^* = \text{preliminary (P) quarterly number of migrants from month } t \text{ to month } t+2 \text{ aligned with preliminary annual net numbers for the province or territory of origin } j, \text{ and the destination province or territory } k.$$

An adjustment is then applied to quarterly matrix ${}^D Q_{t,t+2}$ to align net numbers with those of the sum of the three corresponding monthly matrices.

The adjustment involves calculating the difference between the net numbers of the quarterly matrix and those of the sum of the monthly matrices for the three months of the quarter. Note that net interprovincial migration in the final monthly matrices has already been aligned with the annual net numbers.

Equation 10.6:

$${}^D \Delta_{t,t+2} = ({}^D Q_{k,j,t,t+2} - {}^D Q_{j,k,t,t+2}) - ({}^D SM_{k,j,t,t+2}^* - {}^D SM_{j,k,t,t+2}^*)$$

The differences are then used to change the number of migrants in the quarterly matrix to align the quarterly net numbers with those of the sum of the three monthly matrices for the three months of the quarter.

Each item (j,k) of the adjusted matrix is obtained as follows:

Equation 10.7:

$${}^D Q_{j,k,t,t+2}^* = {}^D Q_{j,k,t,t+2} + {}^D \Delta_{t,t+2} \times \frac{{}^D Q_{j,k,t,t+2}}{{}^D Q_{j,k,t,t+2} + {}^D Q_{k,j,t,t+2}}$$

where

$${}^D Q_{j,k,t,t+2}^* = \text{final (D) quarterly number of migrants adjusted so that net numbers match those of the sum of the three corresponding monthly matrices for the province or territory of origin } j, \text{ and the destination province or territory } k.$$

Various adjustments are made to matrix ${}^D Q_{t,t+2}^*$ to avoid negative values or division by zero. This matrix contains the final quarterly numbers of migrants adjusted so that the net numbers match those of the sum of the three corresponding monthly matrices.

Final interprovincial migration estimates, subprovincial areas

The methodology used to produce final estimates of interprovincial migration at the subprovincial level is essentially the same as the provincial/territorial estimates, and are based primarily on the T1FF. As the migration estimates are produced initially at the CD, CMA and CA level (see section [Final interprovincial migration estimates](#)),

the calculation of in-migrants, out-migrants, and net migrants can also be performed at these subprovincial levels. A calibration step is also included to ensure consistency with the provincial/territorial estimates.

For interprovincial migration by economic regions (ERs), the final estimates are produced by aggregating CD totals for each corresponding ER. The estimates are then calibrated to ensure consistency with the provincial/territorial estimates.

Limitations of final interprovincial migration estimates

Although the T1FF has strong coverage of the population,⁵⁷ adjustments are still required to cover the entire population. An assumption is introduced through the adjustments where the migration patterns of those not captured in two consecutive T1FF are the same as those that were captured. It is possible for those not captured in the T1FF to behave differently in terms of migration.

The reference period of two consecutive T1FF is also slightly different from the reference period of annual estimates. The migrations captured in the T1FF (approximately from April to April) may vary from those that would have occurred from the reference period of July 1 to June 30.

The more notable limitation of the T1FF is the frequency and timing at which the data is available. The file is produced on an annual basis and are not available in time for production of preliminary estimates of a given reference period. As such, the CCB is used instead as the primary data source in producing the preliminary estimates of interprovincial migration.

Preliminary interprovincial migration estimates

Data sources

The Canada Child Benefit (CCB) is a tax-free monthly payment made to eligible families with children under 18 years of age. Information from the Canada Child Benefit (CCB) program is provided by the Canada Revenue Agency on a monthly basis, and the data is used to identify migration of children.

The T1 Family File (T1FF) is an annual administrative tax file processed by Statistics Canada. The T1FF contains income and demographic information of tax filers and their dependants for subprovincial geographic areas. The file is created using various administrative data provided by Canada Revenue Agency, including the T1, T4, and the Canada Child Benefit.

Estimation methodology

Preliminary estimates of migration between provinces and territories are produced using CCB data, along with data from T1FF. Because the CCB program is not universal and does not provide direct information on the number of adult migrants, this estimation requires three adjustment factors to derive the complete estimate of interprovincial migration:

1. the program's partial coverage (i.e. to take into account those who have not applied for the CCB);
2. the differential propensity to migrate between children who are registered to the CCB program and all children;
3. the differential propensity to migrate of adults versus children.

The three adjustment factors use CCB and T1FF data. The methods for estimating the interprovincial migration rates of children (aged 0 to 17 years) and adults (aged 18 years and older) are described in the next section.

Interprovincial migration of children

Given that T1FF are produced annually and are not available when preliminary estimates are being produced, preliminary estimates of interprovincial migration are based on monthly microdata from CCB administrative files, from which the number of child migrants can be extracted. The data can be used to derive information on the

57. For the 2022 tax year, the coverage rate of the T1FF is 94.4% of the population. For more information, please refer to [Technical Reference Guide for the Annual Income Estimates for Census Families, Individuals and Seniors, T1 Family File](#).

usual province or territory of residence of children registered in the CCB program. Therefore, monthly, quarterly and annual migration can be estimated by comparing two CCB microdata files.

The estimation of interprovincial migration of children involves two adjustment factors. The first factor reflects the CCB program's coverage: the ratio of the number of children as estimated by the Demographic Estimates Program, to the number of children who are registered to the CCB program, for each month and province and territory. The second factor, which corrects for any biases resulting from the differential propensity to migrate between children who are registered to the CCB program and all children, is obtained by comparing the interprovincial out-migration rates of children who are registered to the CCB program with the out-migration rates for all children (aged 0 to 17). The adjustment factor is calculated for each province and territory and is based on the two last available years of the T1FF.

A matrix is used to represent interprovincial migration between 13 provinces and territories of origin (denoted by j) and 13 destination provinces and territories (denoted by k). Each item (j,k) of the matrix represents both the number of out-migrants from province or territory of origin j and the number of in-migrants to destination province or territory k .

The formula used to estimate each item (j,k) of the matrix for the interprovincial migration of children is as follows:

Equation 10.8:

$${}_{j,k}M^{0-17} = {}_{j,k}^{CCB}M^{0-17} \times \frac{I}{{}_{j}^{CCB}\mathfrak{R}} \times {}_jG$$

where

${}_{j,k}M^{0-17}$	=	number of children migrating from province or territory of origin j to destination province or territory k ;
${}_{j,k}^{CCB}M^{0-17}$	=	number of children in the CCB database migrating from province or territory of origin j to destination province or territory k ;
${}_{j}^{CCB}\mathfrak{R}$	=	coverage rate of the CCB program for the province or territory of origin j ;
${}_jG$	=	adjustment factor for differential migration propensity among children for the province or territory of origin j .

The equation above includes the adjustments for incomplete coverage of CCB-children who are registered to the CCB program (Equation 10.9) and for the differences in the propensities of this group to migrate as compared to all children (Equation 10.10).

The coverage rates are calculated as follows:

For each province or territory,

Equation 10.9:

$${}_{j}^{CCB}\mathfrak{R} = \left[\frac{{}_{j}^{CCB}P^{0-17}}{{}_{j}^{Dem}P^{0-17}} \right]$$

where

${}_{j}^{CCB}P^{0-17}$	=	number of children in province or territory j on the basis of CCB data; and
${}_{j}^{Dem}P^{0-17}$	=	number of children in province or territory j according to the population estimates from the Demographic Estimates Program.

The differential migration propensity is based on a set of G_j factors. Using tax data, the G_j factors are obtained by dividing the interprovincial out-migration rates for all children by the out-migration rates of children who are registered to the CCB program, as follows:

For each province and territory:

Equation 10.10:

$${}_jG = \left[\frac{{}_{T1FF}_j Rate_M^{0-17}}{{}_{CCB}_j Rate_M^{0-17}} \right] = \frac{\left[\frac{{}_{T1FF}_j M^{0-17}}{{}_{T1FF}_j P^{0-17}} \right]}{\left[\frac{{}_{CCB}_j M^{0-17}}{{}_{CCB}_j P^{0-17}} \right]}$$

where

- ${}_{T1FF}_j Rate_M^{0-17}$ = interprovincial out-migration rate of all children from province or territory of origin j , based on T1FF;
- ${}_{CCB}_j Rate_M^{0-17}$ = interprovincial out-migration rate of children who are registered to the CCB program from province or territory of origin j ;
- ${}_{T1FF}_j M^{0-17}$ = number of total out-migrant children from province or territory of origin j , based on T1FF;
- ${}_{T1FF}_j P^{0-17}$ = estimate of children in province or territory j based on T1FF;
- ${}_{CCB}_j M^{0-17}$ = number of out-migrant children who are registered to the CCB program from province or territory j ;
- ${}_{CCB}_j P^{0-17}$ = Children who are registered to the CCB program, by province or territory j .

The G_j factor will equal one if the migration rate of children who are registered to the CCB program and the migration rate of all children are identical. A value of G_j that is greater (or less) than one indicates that the propensity to migrate of children who are registered to the CCB program is less (or greater) than that of all children.

Interprovincial migration of adults

The second factor for adjusting the estimates produced using CCB data is used in the calculation of the number of adult migrants. Estimates of adults migrating across provincial or territorial boundaries are obtained by calculating modelled migration ratios of adults to children, called the F factors. The F factors, which are calculated using the most recent T1FF data, are the ratio of the adult migration rate to the child migration rate, by province or territory of origin and by destination province or territory, as follows:

For each province and territory of origin and each destination province and territory,

Equation 10.11:

$${}_{j,k}F_{t-3,t} = \left[\frac{{}_{j,k} Avg_Rate_M^{18+}}{{}_{j,k} Avg_Rate_M^{0-17}} \right] = \frac{\left[\frac{{}_{T1FF}_{j,k} M_{t-3,t-2}^{18+} + {}_{T1FF}_{j,k} M_{t-2,t-1}^{18+} + {}_{T1FF}_{j,k} M_{t-1,t}^{18+}}{Dem_j P_{t-2}^{18+}} \right]}{\left[\frac{{}_{T1FF}_{j,k} M_{t-3,t-2}^{0-17} + {}_{T1FF}_{j,k} M_{t-2,t-1}^{0-17} + {}_{T1FF}_{j,k} M_{t-1,t}^{0-17}}{Dem_j P_{t-2}^{0-17}} \right]}$$

where

${}_{j,k}F_{t-3,t}$	=	average estimation factor for adults calculated over three migration periods by province or territory of origin j and destination province or territory k ;
${}_{j,k}Avg_Rate_M^{18+}$	=	average rate of interprovincial migration of adults over three migration periods by province or territory of origin j and destination province or territory k ;
${}_{j,k}Avg_Rate_M^{0-17}$	=	average rate of interprovincial migration of children over three migration periods by province or territory of origin j and destination province or territory k ;
${}^{T1FF}M_{j,k}^{18+}$	=	number of adult migrants by province or territory of origin j and destination province or territory k on the basis of T1FF data for period $(t-3, t-2)$, $(t-2, t-1)$ and $(t-1, t)$;
${}^{Dem}P_{j,t-2}^{18+}$	=	number of adults for the province or territory of origin j at time $(t-2)$ according to the population estimates from the Demographic Estimates Program;
${}^{T1FF}M_{j,k}^{0-17}$	=	number of child migrants by province or territory of origin j and destination province or territory k on the basis of T1FF data for periods $(t-3, t-2)$, $(t-2, t-1)$ and $(t-1, t)$; and
${}^{Dem}P_{j,t-2}^{0-17}$	=	number of children for the province or territory of origin j at time $(t-2)$ according to the population estimates from the Demographic Estimates Program.

The $F_{j,k}$ factors once applied to the child migration rates (based on adjusted CCB data) produces estimates of adult interprovincial migration rates. These are then multiplied by the provincial or territorial populations to obtain estimates of the number of adults migrating between provincial and territorial borders, as follows:

For each province and territory,

Equation 10.12:

$${}_{j,k}M^{18+} = \frac{{}_{j,k}M^{0-17}}{{}^{Dem}P_j^{0-17}} \times {}^{Dem}P_j^{18+} \times {}_{j,k}F_{t-3,t}$$

where

${}_{j,k}M^{18+}$	=	estimated number of adults migrating from province or territory of origin j to destination province or territory k ;
$\frac{{}_{j,k}M^{0-17}}{{}^{Dem}P_j^{0-17}}$	=	rate of migration of children (estimates by province or territory of origin j and destination province or territory k on the basis of adjusted CCB data and the population estimates from the Demographic Estimates Program); and
${}^{Dem}P_j^{18+}$	=	number of adults in province or territory of origin j at the beginning of the period according to the population estimates from the Demographic Estimates Program.

Finally, after estimates for the total numbers of interprovincial child and adult migrants have been separately calculated by province or territory of origin j and destination province or territory k , interprovincial migration estimates are obtained by adding the number of interprovincial child and adult migrants as follows:

For each province and territory,

Equation 10.13:

$${}_{j,k}M = {}_{j,k}M^{0-17} + {}_{j,k}M^{18+}$$

Preliminary interprovincial migration estimates by age and gender

To produce the preliminary interprovincial migration estimates by age and sex at the provincial and territorial level, the average of three most recent age and gender distributions of final estimates is applied. This procedure has been used for estimates from 2021/2022 onwards.

For details on the previous methodology, please refer to the 2015 edition of this publication.

Aligning estimates from different measurement periods

The monthly, quarterly and annual number of migrants can be calculated using monthly CCB microdata. However, adjustments must be made to the numbers of migrants to align the net interprovincial migration of the different measurement periods for which estimates are derived, similarly to those performed for final estimates (see section [Final interprovincial migration estimates](#)).

Aligning monthly net numbers with quarterly net numbers

Each quarter, monthly data must be adjusted to align the monthly net numbers with the quarterly net numbers.

First, the difference between the net values of the sum of the three monthly matrices and those of the quarterly matrix is calculated for each combination of origin and destination:

Equation 10.14:

$${}^P\Delta_{t,t+2} = \left({}^P_{k,j}SM_{t,t+2} - {}^P_{j,k}SM_{t,t+2} \right) - \left({}^P_{k,j}Q_{t,t+2} - {}^P_{j,k}Q_{t,t+2} \right)$$

where

- ${}^P_{j,k}\Delta_{t,t+2}$ = difference in number of migrants between the sum of the preliminary (P) monthly matrices and the preliminary (P) quarterly matrix for the province or territory of origin j , and the destination province or territory k ;
- ${}^P_{j,k}SM_{t,t+2}$ = sum of the preliminary (P) monthly number of migrants from month t to month $t+2$ for the province or territory of origin j , and the destination province or territory k ; and
- ${}^P_{j,k}Q_{t,t+2}$ = preliminary (P) quarterly number of migrants for the quarter covering months t to $t+2$ for the province or territory of origin j , and the destination province or territory k .

These differences are used to change the number of migrants to create a new matrix in which the net numbers match those of the quarterly matrix.

Each item (j,k) of the adjusted matrix is obtained as follows:

Equation 10.15:

$${}^P_{j,k}SM_{t,t+2}^* = {}^P_{j,k}SM_{t,t+2} + {}^P_{j,k}\Delta_{t,t+2} \times \frac{{}^P_{j,k}SM_{t,t+2}}{{}^P_{j,k}SM_{t,t+2} + {}^P_{k,j}SM_{t,t+2}}$$

where

- ${}^P_{j,k}SM_{t,t+2}^*$ = sum of the preliminary (P) monthly number of migrants from month t to month $t+2$ adjusted so that net numbers match those of the quarterly matrix for the province or territory of origin j , and the destination province or territory k .

Various adjustments are made to matrix ${}^P_{j,k}SM_{t,t+2}^*$ to avoid negative values or division by zero.

Lastly, for each of the three months in the quarter, the adjusted monthly interprovincial migration matrix is derived using the matrix resulting from the equation above. Each matrix item (j,k) is adjusted as follows:

Equation 10.16:

$${}^P M_{j,k}^* = {}^P M_t \times \frac{{}^P SM_{t,t+2}^*}{{}^P SM_{t,t+2}}$$

where

${}^P M_{j,k}^*$ = sum of the preliminary (P) monthly number of migrants from month t to month $t+2$ adjusted so that net numbers match those of the quarterly matrix for the province or territory of origin j , and the destination province or territory k .

${}^P M_t$ = preliminary (P) monthly number of migrants for month t for the province or territory of origin j , and the destination province or territory k .

This matrix contains the preliminary monthly numbers of migrants adjusted so that net numbers match the quarterly net interprovincial numbers.

Aligning monthly net numbers with annual net numbers

Each year, the monthly interprovincial migration estimates must be adjusted to align the monthly net numbers with the net numbers of the annual matrix.

The adjustment involves calculating the difference between the net numbers of the sum of the 12 monthly matrices ${}^P M_t^*$ and the net numbers of the annual matrix for each combination of origin and destination:

Equation 10.17:

$${}^P \Delta_{t,t+11} = \left({}^P SM_{t,t+11}^* - {}^P SM_{t,t+11}^* \right) - \left({}^P A_{t,t+11} - {}^P A_{t,t+11} \right)$$

where

${}^P \Delta_{t,t+11}$ = difference in number of migrants between the sum of the preliminary (P) monthly matrices adjusted for the quarters and the preliminary (P) annual migration matrix for the province or territory of origin j , and the destination province or territory k ;

${}^P SM_{t,t+11}^*$ = sum of the preliminary (P) monthly number of migrants from month t to month $t+11$ adjusted for the quarters for the province or territory of origin j and the destination province or territory k ; and

${}^P A_{t,t+11}$ = preliminary (P) annual number of migrants for the year covering months t to $t+11$ for the province or territory of origin j , and the destination province or territory k .

These differences are then used to change the number of migrants to create a new matrix in which the monthly net numbers match the annual net numbers.

Each item (j,k) of this matrix is calculated as follows:

Equation 10.18:

$${}^P SM_{t,t+11}^{**} = {}^P SM_{t,t+11}^* + {}^P \Delta_{t,t+11} \times \frac{{}^P SM_{t,t+11}^*}{{}^P SM_{t,t+11}^* + {}^P SM_{t,t+11}^*}$$

where

${}^P SM_{t,t+11}^{**}$ = sum of the preliminary (P) monthly number of migrants from month t to month $t+11$ for the province or territory of origin j , and the destination province or territory k the net numbers of which match the preliminary annual net numbers.

Adjustments are made to matrix ${}^P SM_{t,t+1}^{**}$ to avoid negative values or division by zero.

Lastly, for each of the 12 months, the adjusted monthly interprovincial migration matrix is derived by obtaining each item (j,k) as follows:

Equation 10.19:

$${}^P M_{j,k}^{**} = {}^P M_{j,k}^* \times \frac{{}^P SM_{t,t+1}^{**}}{{}^P SM_{t,t+1}^*}$$

where

$${}^P M_{j,k}^{**} = \text{preliminary (P) monthly number of migrants for month } t \text{ adjusted so that net numbers match annual net numbers for the province or territory of origin } j, \text{ and the destination province or territory } k.$$

This matrix contains the preliminary monthly numbers of migrants adjusted so that the net numbers match the annual net interprovincial numbers.

Aligning quarterly net numbers with annual net numbers

Each year, when the annual matrix is created, the quarterly net numbers must also be aligned with the annual net numbers.

The adjustment involves calculating the difference between the net numbers of the quarterly matrix and those of the sum of the matrices for the three months of the quarter. Note that net interprovincial migration in the preliminary monthly matrices has already been aligned with annual net numbers.

Equation 10.20:

$${}^P \Delta_{t,t+2}^* = \left({}^P Q_{k,j,t,t+2} - {}^P Q_{j,k,t,t+2} \right) - \left({}^P SM_{t,t+2}^{**} - {}^P SM_{t,t+2}^* \right)$$

where

$${}^P \Delta_{t,t+2}^* = \text{difference in number of migrants between the preliminary (P) quarterly migration matrix and the sum of the preliminary (P) monthly matrices adjusted for annual net numbers for the province or territory of origin } j, \text{ and the destination province or territory } k.$$

The differences are then used to change the quarterly number of migrants so that the net numbers of the quarterly matrix match those of the sum of the net numbers of the monthly matrices for the three corresponding months.

Each item (j,k) of the adjusted matrix is obtained as follows:

Equation 10.21:

$${}^P Q_{j,k,t,t+2}^* = {}^P Q_{j,k,t,t+2} + {}^P \Delta_{t,t+2}^* \times \frac{{}^P Q_{j,k,t,t+2}}{{}^P Q_{j,k,t,t+2} + {}^P Q_{k,j,t,t+2}}$$

where

$${}^P Q_{j,k,t,t+2}^* = \text{preliminary (P) quarterly number of migrants covering months } t \text{ to } t+2 \text{ adjusted so that net numbers match annual net numbers for the province or territory of origin } j, \text{ and the destination province or territory } k.$$

Adjustments are made to matrix ${}^P Q_{t,t+2}^*$ to avoid negative values or division by zero.

This matrix contains the preliminary quarterly number of migrants adjusted so that the net numbers match the annual net interprovincial numbers.

Preliminary interprovincial migration estimates, subprovincial areas

For preliminary estimates of interprovincial migration at the CD, CMA and CA level, CCB administrative files are used to estimate the migration of children (aged 0 to 17), while the migration of adults is derived using rates based on previous year's final data. A calibration step is also included to ensure consistency with the provincial/territorial estimates.

For interprovincial migration by economic regions (ER), the preliminary estimates are produced by aggregating CD totals for each corresponding ER. The estimates are then calibrated to ensure consistency with the provincial/territorial estimates.

Limitations of preliminary interprovincial migration estimates

The adjustments for coverage as well as propensity for the CCB implies some assumptions in the estimation. The first is that the migration pattern of children not captured in the CCB is the same as those that are captured. The other assumption is that the differential propensity of migration is the same as the previous year. Although both assumptions are considered as reasonable, it is possible for the migration pattern and the propensity to be different.

With regards to provincial estimates, as the information from the CCB focuses on children, the migrations of adults are calculated based on the migration ratios of adults to children. However, the migration patterns of the two groups can diverge at times. For subprovincial estimates, the migration of adults is derived using rates based on previous year's final data. It is certainly possible for migrations of adults to change abruptly from one year to the next. These limitations are addressed once the T1FF data becomes available, with the production of final estimates of interprovincial migration.

Chapter 11

Intraprovincial migration

Introduction

Intraprovincial migration represents all movement from one region to another within the same province or territory involving a change of the usual place residence. Interprovincial migration also involves a change in usual place of residence, but these movements occur between provinces and territories. The term internal migration may refer to either interprovincial migration or intraprovincial migration, or both. This chapter focuses on the intraprovincial migration component. For information on interprovincial migration, see [Chapter 10](#).

As with interprovincial migration, there is no provision for recording intraprovincial migration in Canada. Consequently, this component of demographic growth is estimated using administrative data. The methods used to prepare estimates of intraprovincial migration will be discussed in this chapter.

Definitions and concepts

Intraprovincial migration is the movement of persons from one region to another within a given province or territory, involving a change to their usual place of residence. These movements are measured by comparing the place of residence at the beginning and end of the measurement period.

Given the definition of intraprovincial migration, estimates are typically provided at the subprovincial level, for a given region. Migrations within a given region are not included.

At the provincial/territorial level, there is no net effect of intraprovincial migration to the population estimates, as all intraprovincial migrants remain within the province/territory. The sum of intraprovincial in-migrants and out-migrants at the provincial/territorial level is identical, and corresponds to the total number of intraprovincial migrants of a given province/territory for a given type of geography.

Canada Revenue Agency (CRA) provides Statistics Canada with data from the Canada child benefit (CCB) program and personal income tax returns (such as T1 and T4), which are used to estimate intraprovincial migration.

Final intraprovincial migration estimates

Data sources

The T1 Family File (T1FF) is an annual administrative tax file processed by Statistics Canada. The T1FF contains income and demographic information of tax filers and their dependants for subprovincial geographic areas. The file is created using various administrative data including those provided by Canada Revenue Agency, such as the T1, T4, and the Canada Child Benefit.

The Canada Child Benefit (CCB) is a tax-free monthly payment made to eligible families with children under 18 years of age. Information from the CCB program is provided by the Canada Revenue Agency on a monthly basis, and the data is used to identify migration of children.

Estimation methodology

Final estimates of intraprovincial migration are produced using the T1FF. By comparing the place of residence at the time of filing, it is possible to identify for those persons who file returns for two consecutive years, those who move, their place of origin and their destination. The development of migration data involves four main steps:

1. geocoding of tax records;
2. estimation of non-filing dependants of tax filers, by age group and gender;
3. identification of migrant tax filers by age group and gender;
4. adjustment for the population not covered by the T1FF.

The four steps of the estimation methodology are described below.

Step 1 – Geocoding

The migration data developed from the taxation records are estimates of migration flows between census divisions (CDs) or census metropolitan areas (CMAs) and census agglomerations (CAs). The geographic coding of CDs, CMAs, and CAs on the tax records is done primarily on the basis of the postal code, which is a part of the mailing address. About 99% of all tax records are filed with a postal code, or are assigned one, based on the filer's address by matching the address to a file similar to the Postal Code Directory from Canada Post. As the tax return is usually submitted several months after the end of the tax year, the postal codes correspond to those existing in the spring of the year following the tax year.

Step 2 – Estimation of dependants

Since the tax records source file has no direct information on the number and characteristics of non-filing dependants, this information must be imputed. The estimation of tax filers' dependants is based on the T1FF. Families are created by linking all filing family members together, using spousal social insurance numbers, marital status, and matched addresses. Non-filing spouse is imputed whenever a filer has declared himself or herself married but was not linked to a filing spouse. Children are imputed based on CCB data, which carry the social insurance number of the parent receiving the benefit, as well as from previous T1FF. Newborns are added to tax filer records from Statistics Canada's Birth Database.

The family data from the T1FF are then used to create a file of individual tax filers for the migration system. The migration file contains information for each tax filer and assigns dependants to each tax filer based on the number of filers in the family, and the number of dependants. If only one parent in the family has filed a tax return, then all dependants, including the spouse, if one exists, are added to the tax filer's record. If both parents filed tax returns, and their family record contained dependant children, then each tax filer would receive half the count of dependants.

Step 3 – Identifying migrant tax filers

After assigning the geographic codes and non-filing dependants to each tax filer, records for two consecutive years are matched by social insurance number. Only records of tax filers who are present in both years are retained. Migrant tax filers are identified by comparing current and previous geography codes (CDs, CMAs, or CAs). Thus, it is only possible to determine migrant status for those who file in two consecutive years. The identification of migrants is based on their address at the time of filing, and thus the migration period is not precisely one year, but it is assumed to be close. The assumed reference period is around April to April, of the year following each tax year. However, in Statistics Canada's Demographic Estimates Program, the given estimates cover the period from July to June. Tax filers' non-filing dependants are assumed to have the same migration behaviour as that of the filers to whom they are assigned.

Step 4 – Coverage adjustment factor

The final step in the estimation process is an adjustment for coverage, performed at the CD, CMA, and CA level for gender and specific age groups. This adjustment is required to estimate those migrants who did not file two consecutive personal income tax returns, which involves the calculation of coverage adjustment factors.

The coverage adjustment factors are calculated by dividing the population estimates from the Demographic Estimates Program of a given CD, CMA or CA with the T1FF counts, for each gender and age group.

The adjustment factors are applied to the counts of intraprovincial migrants derived in Step 3 to obtain an estimate of total migrants. The basic assumption is that the population not covered by the taxation system has the same rate of migration as those for whom it can be measured.

The migration estimates of individuals from one region to another within a province/territory (whether at CD, CMA or CA level) are then aggregated to obtain the estimates of in-migrants, out-migrants, and net intraprovincial migration⁵⁸ for each region. A calibration step is also included to ensure consistency.

58. Net intraprovincial migration is the difference between in-migrants and out-migrants for a given province or territory.

For intraprovincial migration by economic regions (ERs), the final estimates are produced by aggregating CD totals for each corresponding ER. The estimates are then calibrated to ensure consistency.

Final intraprovincial migration estimates by age and gender

Final intraprovincial migration estimates are derived from the T1FF file consisting of age and gender, as well as the region of origin and destination. The out-migrant data by single year of age is used to distribute the previously produced data by broad age group. Due to the nature of splitting broad age groups into single year of age, some sharp breaks can still remain around the ages at the boundaries of the original age groups. To smooth out the transitions, a simple Gaussian smoothing method is applied across the distributions by single year of age. Estimates from 2021/2022 onwards are based on this method.⁵⁹

Limitations to final intraprovincial migration estimates

Although the T1FF has strong coverage of the population,⁶⁰ adjustments are still required to cover the entire population. An assumption is introduced through the adjustments where the migration patterns of those not captured in two consecutive T1FF are the same as those that were captured. However, it is possible for those not captured in the T1FF to behave differently in terms of migration.

The reference period of two consecutive T1FF is also slightly different from the reference period of annual estimates. The migrations captured in the T1FF (approximately from April to April) may vary from those that would have occurred from the reference period of July 1 to June 30.

The more notable limitation of the T1FF is the frequency and timing at which the data is available. The file is produced on an annual basis and is not available in time for production of preliminary estimates of a given reference period. As such, the CCB is used as the primary data source to produce preliminary intraprovincial migration estimates for children aged 0 to 17, while the previous year's T1FF is used to calculate migration rates for those aged 18 and older.

Preliminary intraprovincial migration estimates

Data sources

The Canada Child Benefit (CCB) is a tax-free monthly payment made to eligible families with children under 18 years of age. Information from the CCB program is provided by the Canada Revenue Agency on a monthly basis, and the data is used to identify migration of children.

The T1 Family File (T1FF) is an annual administrative tax file processed by Statistics Canada. The T1FF contains income and demographic information for subprovincial geographic areas. The file is created using various administrative data provided by Canada Revenue Agency, including the T1, T4, and the CCB.

Estimation methodology

Preliminary⁶¹ estimates of migration between regions within the same province or territory are produced using CCB data, along with data from T1FF. Because the CCB program is not universal and does not provide direct information on the number of adult migrants, it is used only to estimate the intraprovincial migration of children aged 0 to 17 years old. Unlike interprovincial migration estimation methods, which use adjustments and modelling based on children's migration to estimate migration for adults aged 18 and older, intraprovincial migration estimates do not use these methods, as some small subprovincial areas often have data that are too limited.

59. Details on the previous methodology can be found in the 2015 edition of this publication.

60. For the 2023 tax year, the coverage rate of the T1FF is 94.5% of the population. The coverage rate has remained fairly stable over the years. For more information, please refer to [Technical Reference Guide for the Annual Income Estimates for Census Families, Individuals and Seniors, T1 Family File](#).

61. Unless otherwise noted, the term "preliminary" includes both preliminary and updated estimates when it refers to components.

Intraprovincial migration of children

Given that the T1FF is produced annually and is not available when preliminary estimates are being produced, preliminary estimates of intraprovincial migration of children aged 0 to 17 years old are based on monthly microdata from CCB administrative files, from which the number of child migrants can be extracted. The data can be used to derive information on the region (CD, CMA, CA) of usual of residence of children registered in the CCB program. Therefore, annual migration of children can be estimated by comparing two CCB microdata files.

The estimation of intraprovincial migration of children involves two adjustment factors. The first factor reflects the CCB program's coverage: the ratio of the number of children as estimated by the Demographic Estimates Program, to the number of children who are registered to the CCB program, for each region. The second factor, which corrects for any biases resulting from the differential propensity to migrate between children who are registered to the CCB program and all children, is obtained by comparing the intraprovincial out-migration rates of children who are registered to the CCB program with the out-migration rates for all children (aged 0 to 17). The adjustment factor is calculated for each province and territory and is based on the two last available years of the T1FF.

A matrix is used to represent intraprovincial migration between regions of origin (denoted by m) and regions of destination (denoted by n). Each item (m,n) of the matrix represents both the number of out-migrants from region of origin m and the number of in-migrants to destination region n .

The formula used to estimate each item (m,n) of the matrix for the intraprovincial migration of children is as follows:

Equation 11.1:

$${}_{m,n}M^{0-17} = {}_{m,n}^{CCB}M^{0-17} \times \frac{I}{{}_{m}^{CCB}\mathfrak{R}} \times {}_jG$$

where

${}_{m,n}M^{0-17}$	=	preliminary estimated number of children migrating from region of origin m to destination region n ;
${}_{m,n}^{CCB}M^{0-17}$	=	number of children in the CCB database migrating from region of origin m to destination region n ;
${}_{m}^{CCB}\mathfrak{R}$	=	coverage rate of the CCB program for the region of origin m ;
${}_jG$	=	adjustment factor for differential migration propensity among children for the corresponding province or territory of origin j .

The equation above includes the adjustments for incomplete coverage of CCB-children who are registered to the CCB program (Equation 11.2) and for the differences in the propensities of this group to migrate as compared to all children (Equation 11.3).

The coverage rates are calculated as follows:

For each region m ,

Equation 11.2:

$${}_{m}^{CCB}\mathfrak{R} = \left[\frac{{}_{m}^{CCB}P^{0-17}}{{}_{m}^{Dem}P^{0-17}} \right]$$

where

${}_{m}^{CCB}P^{0-17}$	=	number of children in region m on the basis of CCB data;
${}_{m}^{Dem}P^{0-17}$	=	number of children in region m according to the population of the Demographic Estimates Program.

The differential migration propensity is based on a set of G_j factors. Using tax data, the G_j factors are obtained by dividing the intraprovincial out-migration rates for all children by the out-migration rates of children who are registered to the CCB program, as follows:

For each region:

Equation 11.3:

$${}_jG = \left[\frac{{}_{T1FF}Rate_{-M}^{0-17}}{{}_{CCB}Rate_{-M}^{0-17}} \right] = \frac{\left[\frac{{}_{T1FF}M^{0-17}}{{}_{T1FF}P^{0-17}} \right]}{\left[\frac{{}_{CCB}M^{0-17}}{{}_{CCB}P^{0-17}} \right]}$$

where

- ${}_{T1FF}Rate_{-M}^{0-17}$ = intraprovincial out-migration rate of all children from province or territory of origin j , based on T1FF;
- ${}_{CCB}Rate_{-M}^{0-17}$ = intraprovincial out-migration rate of children who are registered to the CCB program from province or territory of origin j ;
- ${}_{T1FF}M^{0-17}$ = number of total out-migrant children from province or territory of origin j , based on T1FF;
- ${}_{T1FF}P^{0-17}$ = number of children from province or territory j based on T1FF;
- ${}_{CCB}M^{0-17}$ = number of out-migrant children who are registered to the CCB program from province or territory j ;
- ${}_{CCB}P^{0-17}$ = number of children who are registered to the CCB program from province or territory j .

The G_j factor will equal one if the migration rate of children who are registered to the CCB program and the migration rate of all children are identical. A value of G_j that is greater (or less) than one indicates that the propensity to migrate of children who are registered to the CCB program is less (or greater) than that of all children.

The G_j factors are calculated in a similar fashion between interprovincial migration and intraprovincial migration. However, the values will be different given that the respective migration estimates are used to derive the factors (i.e. interprovincial vs. intraprovincial).

Intraprovincial migration of adults

Preliminary estimates of adults migrating from one region to another within the same province or territory are obtained by modelling rates based on previous year's final migration data as well as on population estimates from the Demographic Estimates Program.

Equation 11.4:

$${}_{m,n}M_y^{18+} = \frac{{}_{m,n}M_{y-1}^{18+}}{{}_jP_{y-1}^{18+}} \times {}_jP_y^{18+}$$

where

$$\begin{aligned}
 {}_{m,n}M_y^{18+} &= \text{preliminary estimated number of adults migrating from region of origin } m \text{ to destination region } n, \text{ at reference year } y; \\
 \frac{{}_{m,n}M_{y-1}^{18+}}{{}_jP_{y-1}^{18+}} &= \text{final estimated number of adult migrants from region of origin } m \text{ to destination region } n, \text{ divided by the number of adults according to the population of the Demographic Estimates Program from corresponding province or territory } j, \text{ at reference year } y-1; \\
 {}_jP_y^{18+} &= \text{number of adults according to the population of the Demographic Estimates Program in province or territory of origin } j, \text{ at the reference year } y.
 \end{aligned}$$

Finally, after estimates for the numbers of intraprovincial child and adult migrants have been separately calculated by region of origin m and destination region n , the estimates for the numbers of intraprovincial total migrants are obtained by adding the numbers of intraprovincial child and adult migrants as follows:

For each region m ,

Equation 11.5:
$${}_{m,n}M = {}_{m,n}M^{0-17} + {}_{m,n}M^{18+}$$

where

$${}_{m,n}M = \text{preliminary estimated number of total migrants from region of origin } m \text{ to destination region } n, \text{ at reference year } y.$$

For interprovincial migration by economic regions (ER), the preliminary estimates are produced by aggregating CD totals for each corresponding ER. The estimates are then calibrated to ensure consistency.

Preliminary intraprovincial migration estimates by age and gender

To produce the preliminary intraprovincial migration estimates by age and gender at the subprovincial level, the estimates for the number of child migrants (${}_{m,n}M^{0-17}$) from equation 11.1 are used, which are produced by single year of age using the CCB data. Preliminary estimates of adult migrants by age and gender are obtained by breaking down the estimate of their total number (${}_{m,n}M^{18+}$) using the previous year's final age and gender distribution. A simple Gaussian smoothing method is then applied to across the distribution by single year of age. This procedure has been used for estimates from 2021/2022 onwards.⁶²

Limitations to preliminary intraprovincial migration estimates

The adjustments for coverage as well as for migration propensity for the CCB implies some assumptions in the estimation. The first is that the migration pattern of children not captured in the CCB is the same as those that are captured. The other assumption is that the differential propensity of migration is the same as the previous year. Although both assumptions are considered as reasonable, it is possible for these migration pattern and the propensity to be different.

The migration of adults is derived using rates based on previous year's final data. It is certainly possible for migrations of adults to change abruptly from one year to the next. These limitations are no longer relevant once the T1FF data becomes available, with the production of final estimates of intraprovincial migration for a given year.

62. Details on the previous methodology can be found in the 2015 edition of this publication.

Chapter 12

Estimates of census families, economic entities and households

In addition to population estimates, Statistics Canada produces annual estimates of census families, economic entities and private households for Canada, the provinces and territories. These estimates are available from 2006 onward and are used, notably, to calibrate the survey weights for many Statistics Canada social surveys.

The estimation method described in this chapter produces coherent estimates of these three analytical units. As with population estimates, these estimates can be postcensal or intercensal. Except for the territories, estimates are available by different characteristics, such as family type, gender and age group of parents, age group of children, and size of the family, economic entity or household.

Definitions and concepts

Definitions

For the purposes of these estimates, the definitions of the three analytical units are based on the 2021 Census definitions available in the Census Dictionary.⁶³

A census family is defined as a couple, with or without children; or a parent in a one-parent family, living with at least one child. All members of a particular census family live in the same dwelling. Children can be biological or adopted children, regardless of age, as long as they live in the home without their own spouse or child.

The concept of economic entity includes economic families and persons living outside an economic family, who accordingly constitute economic entities of size 1. According to the census, an economic family is defined as a group of two or more persons living in the same dwelling and related by blood, marriage, common-law union, adoption or foster relationship. By definition, all persons who are members of a census family are also members of an economic family.

A household is defined as a person or group of persons who occupy the same dwelling and have no usual place of residence elsewhere in Canada or abroad. The dwelling can be a collective dwelling or a private dwelling. The household may consist of a family group (census family), of two or more families sharing a dwelling, of a group of unrelated persons or of a person living alone. Household members who are temporarily absent on reference day are considered part of their usual household. The methods presented here are for private households only.

In the estimation method presented below, the term “head” refers to the census reference persons and T1FF tax filers. The way to determine heads depends on each concept:

- Census families:
 - ▶ Couples: each spouse shares the role of head of the family and is therefore equivalent to half a head
 - ▶ One-parent families: the parent is the head
 - ▶ Non-family: each individual is a head.
- Economic entities:
 - ▶ Couples: each spouse is equivalent to half a head, as for census families
 - ▶ One-parent families: the parent is the head
 - ▶ Non-family: each individual is a head.
- Private households:
 - ▶ The primary household maintainer is the head (a household can have more than one maintainer).

63. For more details, see the [Dictionary, Census of Population, 2021](#).

Characteristics of census families, economic entities and households

Estimates are produced for several characteristics and are estimated at the same time as the number of analytical units.⁶⁴ The following are the characteristics:

- Province or territory of residence;
- Age group of heads;
- Gender of heads;
- Type of census family (couple, one-parent family, people not in a census family);
- Size of census family (two, three, four, five, six or more members);
- Age group of children;
- Type of economic entity (couple, one-parent family, non-economic family);
- Size of economic entity (one, two, three, four, five, six or more members);
- Size of household (one, two, three, four, five, six or more members).

Final postcensal estimates

The data and methodology presented in this section are associated with the final postcensal estimates, but also apply to the preliminary and intercensal postcensal estimates, except for some specific aspects discussed in the sections on preliminary postcensal estimates and intercensal estimates.

Data sources

Four data sources are required to produce estimates for these three analytical units: tax data from the T1 Family File (T1FF),⁶⁵ census data, census net undercoverage data from coverage studies, and population estimates. Table 12.1 shows the sources, references and role of the data used to produce estimates for these analytical units.

Table 12.1

Sources, references and role of data used to produce estimates of census families, economic entities and households

Source	Reference	Role
T1 Family File	Income Statistics Division, Statistics Canada	Creation of census correction coefficients
Census	Statistics Canada	Creation of census correction coefficients Distribution of size of analytical units of 6 or more persons
Census coverage studies	Social Survey Methods Division, Statistics Canada	Adjustment of census net undercoverage
Population estimates	Demography Division, Statistics Canada	Adjustment of census net undercoverage

Source: Statistics Canada, Centre for Demography.

64. An analytical unit is defined as a census family, economic entity or private household.

65. The T1 Family File (T1FF) is an annual administrative tax file processed by Statistics Canada. The file is created from a variety of administrative data, including data from the Canada Revenue Agency, such as the T1, T4 and the Canada Child Benefit.

T1FF data are derived primarily from tax returns, most of which are completed in the spring following the reference year. As a result, the annual estimates as of July 1 of year t use T1FF data of fiscal year t-1. Similarly, the calculation of census correction coefficients for year t requires the T1FF file for tax year t-1.

Methodology

Annual estimates of the number of census families, economic entities and private households are based on T1FF tax data with various adjustments. Although the T1FF does not include economic entities and private households, the number of these analytical units can be estimated using this file. The method comprises three steps: adjusting for T1FF biases; adjusting the reference date; and adjusting census coverage.

Step 1 – Adjusting for T1FF biases

T1FF tax data have three limitations in calculating estimates of census families, economic entities and private households. First, they provide coverage that, while excellent, is not complete. Second, the T1FF does not provide information on economic entities and private households. For these reasons, adjustments need to be made to the T1FF by comparing the number of heads of families in the T1FF and the census for each of the three analytical units using census correction coefficients.

These census correction coefficients are calculated for each combination of the characteristics mentioned above. The calculation of this coefficient depends on the number of heads counted in the census, as shown in Table 12.2.

Table 12.2
Possible cases for calculating census correction coefficient

Situation	H_{CF}^{T1FF} (p, a, g, fam, a', g', sf, a'')	$H_i^{Cen} (X)$	$E_i (X)$	Level
1	>0	>0	$\frac{H_i^{Cen}(X)}{H_{CF}^{T1FF}(p, a, g, fam, a', g', sf, a'')}$	8
2	=0	=0	0	0
3	>0	=0	0	0
4	=0	>0	See below	See below

Source: Statistics Canada, Centre for Demography.

where:

$E_i(X)$	=	census correction coefficient is the ratio of the heads of census families, economic entities and households by characteristics (X) to the heads of T1FF families according to ($p; a; g; fam; a'; g'; sf; a''$)
H^{T1FF}	=	T1FF heads
H^{Cen}	=	census family heads
X	=	$p; a; g; fam; a'; g'; sf; a''; ee; se; sh$
p	=	province or territory of residence
a	=	age group
g	=	gender
fam	=	type of census family
a'	=	age group of spouse
g'	=	gender of spouse
sf	=	size of census family
a''	=	age group of children
ee	=	type of economic entity
se	=	size of economic entity
sh	=	size of household
CF	=	census families
EE	=	economic entities
HSD	=	households
i	=	CF, EE or HSD

In Table 12.2, the level refers to the characteristics of census families. For example, in the first case, the correction coefficient is available for each combination of the eight characteristics. In the second and third cases, a correction coefficient of 0 indicates that there is no head of family in the census. The same applies to heads of economic entities and heads of households.

In the fourth case, the correction coefficient is calculated with a specific method that uses T1FF figures at a more aggregated level. This represents a very small portion of the estimates.

These census correction coefficients are calculated in each census year and are assumed to be constant for the entire postcensal period. T1FF biases are adjusted on an annual basis by multiplying the number of heads of families in the T1FF by the census correction coefficients, taking into account the level of each coefficient.

Equation 12.1:

$$CH_i(X) = E_i(X) \times H_{CF}^{T1FF}(X)$$

where

$$CH_i(X) = \text{adjusted number of T1FF heads of families according to characteristics (X) of T1FF census heads of families according to } (p; a; g; fam; a'; g'; a'')$$

Step 2 – Adjusting the reference date

The T1FF data are collected by the end of April of the year following the fiscal year and reflect the situation as of December 31, while the population estimates have different reference dates (such as July 1). The census correction coefficients in step 1 adjust the reference date from December 31 to Census Day since they are based on the census and account for the change in the number of the three analytical units between December 31 and Census Day. Here, the correction applied to the T1FF data adjusts the Census Day reference date of the current year to July 1 of the same year. This time lag is considered using the rates calculated with the population estimates. Since census net undercoverage accounted for in the next step, the population estimates used to calculate the rates exclude net undercoverage adjustment. For an estimate on July 1, the reference date is adjusted as follows:

Equation 12.2:

$$CH_i^{Jul1}(X) = \frac{CH_i^{CD}(X)}{Unadjusted_pop_{CD}^{Dem}(p, a, g)} \times Unadjusted_Pop_{Jul1}^{Dem}(p, a, g)$$

where

$$\begin{aligned} CH_i^{Jul1}(X) &= \text{adjusted number of family heads in the T1FF on July 1} \\ CH_i^{CD}(X) &= \text{adjusted number of family heads in the T1FF on Census Day} \\ Unadjusted_Pop_{CD}^{Dem}(p, a, g) &= Pop_{CD}^{Dem}(p, a, g) - Pop_CNU(p, a, g); \\ Unadjusted_Pop_{Jul1}^{Dem}(p, a, g) &= Pop_{Jul1}^{Dem}(p, a, g) - Pop_CNU(p, a, g); \\ Pop_CNU &= \text{Census net undercoverage} \\ CD &= \text{Census Day of the current year} \end{aligned}$$

Step 3 – Adjusting census coverage

As for the population, an adjustment is needed for incomplete census coverage of census families, economic entities and private households. Coverage studies provide estimates for selected characteristics of census net undercoverage (CNU) of census families and households.

To incorporate characteristics not available in coverage studies, CNU estimates of census families and households are obtained using distributions from the most recent census.

To estimate the CNU of economic entities, the ratio of the number of heads of economic entities to the number of heads of census families is calculated for each combination of characteristics using data from the most recent census. This ratio is then applied to the CNU estimate of census families.

Final equation

By combining the three steps above, it is possible to build the final equation to produce the estimates. For an estimate as of July 1, the equation is as follows:

Equation 12.3:

$$EST_i(X) = \frac{H_{CF}^{T1FF}(X) \times E_i(X)}{Unadjusted_Pop_{CD}^{Dem}(p, a, g)} \times Unadjusted_Pop_{Jul1}^{Dem}(p, a, g) + EST_CNU_i(X)$$

where

$EST_i(X)$ = estimated number of census families, economic entities or private households

$EST_CNU_i(X)$ = estimated census net undercoverage of census families, economic entities or private households

Postcensal estimates of the number of people living in analytical units

In addition to producing estimates of the number of census families, economic entities and households, an estimate of the number of people associated with each of these analytical units can also be produced. It is produced in two parts: first, for units of one to five people, and second, for units of six or more people.

Units of one to five people

For these units, the estimate is direct:

Equation 12.4:

$$IND_i(X | Size \in [1, 5]) = EST_i(X | Size \in [1, 5]) \times Size_i(X)$$

where

$IND_i(X | Size \in [1, 5])$ = estimated number of people in each analytical unit of one to five people

$EST_i(X | Size \in [1, 5])$ = estimated number of analytical units

$Size_i(X)$ = size of the analytical unit

Units of six or more people

Provincial or territorial distributions from the most recent census are used to estimate the average size of analytical units of six or more people. These distributions are then applied to the estimates for each analytical unit. The number of people in each analytical unit with six or more people is produced using the following equation:

Equation 12.5:

$$IND_i(X | Size = 6+) = EST_i(X | Size = 6+) \times AverageSize_i(p)$$

where

$IND_i(X | Size = 6+)$ = estimated number of people in each analytical unit of six or more people

$EST_i(X | Size = 6+)$ = estimated number of each analytical unit of six or more people

$AverageSize_i(p)$ = average size of analytical units of six or more people

Estimated number of people

The total number of people living in each analytical unit can be calculated by adding the two results.

Equation 12.6:

$$IND_i(X) = IND_i(X | Size \in [1, 5]) + IND_i(X | Size = 6 +)$$

Preliminary postcensal estimates

For the first iteration of estimates for a reference date t , the last available T1FF is the T1FF of fiscal year $t-2$. Since the input needed to produce the final postcensal estimates is the T1FF of fiscal year $t-1$, it is necessary to produce preliminary postcensal estimates. For these estimates, the input used is the T1FF of year $t-2$, to which a one-year projection is applied. This projection is calculated using linear regression based on T1FF data from previous years.

Intercensal estimates

Once the postcensal cycle is completed, intercensal estimates can be calculated. The same method is used as for postcensal estimates; only the model parameters differ. The census correction coefficients, the average size for units of six or more people, and the units added to adjust for census net undercoverage are interpolated linearly, while the population estimates used are intercensal.

Limitations

Estimates of the number of census families, economic entities and households are based on integrated tax, census and survey data.

Using families from the T1FF helps to track recent trends and changes between censuses. However, coverage of the population in this file is incomplete. It should therefore be assumed that the census correction coefficients, calculated using the most recent census data, correct these limitations. It should also be assumed that the coefficients reflect the relationships between the three analytical units because they serve to shift from T1FF families to economic entities and households. The coefficients are held constant for the postcensal period in the absence of other available data.

CNU estimates for census families, economic entities and households are calculated using census coverage studies. These sample-based studies are not optimized to provide coverage estimates for these analytical units and do not have all the characteristics required. Characteristics that are not available must be obtained indirectly through the latest census.

Preliminary estimates are produced by making a short-term projection of T1FF data. This approach supposes that very recent family trends continue.

Chapter 13

Quality of Population Estimates

The quality of population estimates is regularly assessed. The Demographic Estimates Program uses two main indicators for this: the precocity error and the error of closure. This chapter describes how these two indicators are calculated.

Precocity error

The precocity error is used to evaluate the quality of preliminary postcensal population estimates and preliminary components of population growth. It measures the trade-off between data accuracy and timeliness, with preference given to the latter.

The precocity error for a given region is calculated by subtracting the final postcensal population estimates from the preliminary postcensal estimates, then dividing the result by the final population estimates.

This calculation can also be used for the components of population growth. It involves subtracting the final estimates of a component from the preliminary estimates and dividing the result by the final postcensal population estimates.

The precocity error is calculated as follows. The example below calculates the error for births:

$$PE_{(t-1,t)} = \frac{(B_{(t-1,t)}^{preliminary} - B_{(t-1,t)}^{final})}{P_{(t-1)}^{postcensal}} \times 1000$$

where:

$PE_{(t-1,t)}$ = precocity error for the period from t-1 to t

$B_{(t-1,t)}^{preliminary}$ = preliminary birth estimate

$B_{(t-1,t)}^{final}$ = final birth estimate

$P_{(t-1)}^{postcensal}$ = postcensal population estimate for the geographical area in question at time t-1

The error can be positive (when the preliminary estimate is higher than the final estimate) or negative (when the final estimate is higher than the preliminary estimate). It is usually expressed per thousand. A small error (i.e., close to zero per thousand) indicates a high level of coherence between the preliminary and final estimates.

Annual precocity errors by province and territory and by component are presented in Table [17-10-0163-01](#).

For most years and jurisdictions, smaller precocity errors are associated with components that have similar sources and methods to calculate preliminary and final estimates, such as births, deaths, and immigration. Conversely, components with more different sources or methods, such as total emigration, net non-permanent residents and interprovincial migration, generally have larger precocity errors.

Error of closure

The error of closure is the main quality indicator for population estimates. It is used to assess the accuracy of postcensal estimates from the previous cycle, before they become intercensal estimates.

The error of closure is defined as the difference between the final postcensal estimate on Census Day and the census population estimate adjusted for coverage errors (base population). The relative error of closure is equal to the error of closure divided by the adjusted census count, expressed as a percentage. Mathematically, the equations are as follows:

$$EC = P_{DEP} - P_{AC}$$

$$EC(\%) = \frac{P_{DEP} - P_{AC}}{P_{AC}} \times 100$$

where:

EC	=	error of closure
$EC(\%)$	=	relative error of closure
P_{DEP}	=	postcensal population estimate on Census Day
P_{AC}	=	census counts adjusted for coverage errors

The error can be positive (when the postcensal population estimates overestimated the population) or negative (when the postcensal population estimates underestimated the population).

The error of closure comes from three sources: errors primarily due to sampling when measuring start-of-period census coverage, errors primarily due to sampling when measuring end-of-period census coverage, and errors in the components of population growth over the intercensal period. For each five-year intercensal period, the error of closure can only be calculated once census data and CNU estimates have been released.

Table 13.1 presents the postcensal population estimates as of May 11, 2021, the adjusted census counts and the errors of closure for Canada, the provinces and territories for the 2001 to 2021 censuses. At the national level, the error of closure was estimated at -41,269 (-0.11%) in 2021. This is down from 2016 (+0.33%).

The population estimates underestimated the population of six provinces, one territory and the country as a whole. Five regions had errors of closure greater than 1% or less than -1%. Of these regions, only the estimated population of the Northwest Territories differed from the adjusted census count by more than +/-2% (+2.57%). In 2016, five provinces and one territory had errors of closure greater than 1% or less than -1%.

By considering CNU variance, statistically significant errors of closure can be identified.

The error of closure is statistically significant for five provinces and one territory, meaning that the population estimates significantly overestimated or underestimated the population of these regions. As mentioned above, these results are due to both the variability in measuring coverage error and the errors measuring the components of population growth. The components most associated with the error of closure are generally interprovincial migration, non-permanent residents and emigration.

Table 13.1
Error of closure of the population estimates, Canada, provinces and territories, 2001 to 2021

Geography	Postcensal estimate on Census Day	Census adjusted for CNU ¹	Error of closure	Error of closure	CNU standard error ²	t value ³
	A	B	C=A-B	D=C/B*100	E	F=C/E
	number		percent		number	
2021						
Canada	38,151,431	38,192,700	-41,269	-0.11	38,241	-1.08
Newfoundland and Labrador	520,244	526,784	-6,540	-1.24	1,829	-3.58
Prince Edward Island	163,796	161,232	2,564	1.59	995	2.58
Nova Scotia	987,291	997,235	-9,944	-1.00	3,452	-2.88
New Brunswick	788,917	789,234	-317	-0.04	2,731	-0.12
Quebec	8,597,350	8,563,460	33,890	0.40	16,829	2.01
Ontario	14,784,027	14,828,005	-43,978	-0.30	28,636	-1.54
Manitoba	1,387,415	1,390,499	-3,084	-0.22	5,145	-0.60
Saskatchewan	1,179,830	1,167,428	12,402	1.06	4,464	2.78
Alberta	4,428,921	4,426,908	2,013	0.05	12,527	0.16
British Columbia	5,185,199	5,214,571	-29,372	-0.56	16,069	-1.83
Yukon	42,849	42,699	150	0.35	174	0.86
Northwest Territories	45,805	44,659	1,146	2.57	228	5.03
Nunavut	39,787	39,986	-199	-0.50	250	-0.80
2016						
Canada	36,149,289	36,029,245	120,044	0.33	43,844	2.74
Newfoundland and Labrador	530,587	529,490	1,097	0.21	2,015	0.54
Prince Edward Island	149,277	146,371	2,906	1.99	870	3.34
Nova Scotia	948,802	941,407	7,395	0.79	3,042	2.43
New Brunswick	756,844	762,836	-5,992	-0.79	2,777	-2.16
Quebec	8,300,572	8,211,537	89,035	1.08	20,613	4.32
Ontario	13,910,005	13,841,676	68,329	0.49	33,316	2.05
Manitoba	1,315,618	1,310,260	5,358	0.41	4,829	1.11
Saskatchewan	1,145,688	1,133,196	12,492	1.10	4,651	2.69
Alberta	4,231,077	4,187,186	43,891	1.05	13,530	3.24
British Columbia	4,741,243	4,845,444	-104,201	-2.15	16,561	-6.29
Yukon	37,853	38,244	-391	-1.02	191	-2.05
Northwest Territories	44,678	44,725	-47	-0.11	257	-0.18
Nunavut	37,045	36,873	172	0.47	229	0.75
2011						
Canada	34,431,763	34,273,205	158,558	0.46	57,546	2.76
Newfoundland and Labrador	513,607	524,728	-11,121	-2.12	2,912	-3.82
Prince Edward Island	145,686	143,590	2,096	1.46	923	2.27
Nova Scotia	948,713	943,638	5,075	0.54	5,346	0.95
New Brunswick	756,533	755,101	1,432	0.19	3,335	0.43
Quebec	7,969,916	7,993,123	-23,207	-0.29	23,660	-0.98
Ontario	13,357,838	13,236,621	121,217	0.92	44,121	2.75
Manitoba	1,252,038	1,230,574	21,464	1.74	6,104	3.52
Saskatchewan	1,055,950	1,063,729	-7,779	-0.73	6,306	-1.23
Alberta	3,774,590	3,777,935	-3,345	-0.09	18,046	-0.19
British Columbia	4,543,776	4,491,451	52,325	1.16	19,494	2.68
Yukon	35,356	35,253	103	0.29	303	0.34
Northwest Territories	44,197	43,439	758	1.74	323	2.35
Nunavut	33,563	34,023	-460	-1.35	608	-0.76
2006						
Canada	32,561,079	32,521,670	39,409	0.12	53,926	0.73
Newfoundland and Labrador	508,694	510,515	-1,821	-0.36	2,710	-0.67
Prince Edward Island	137,723	137,754	-31	-0.02	701	-0.04
Nova Scotia	934,023	938,020	-3,997	-0.43	4,885	-0.82
New Brunswick	748,729	746,056	2,673	0.36	3,105	0.86
Quebec	7,643,258	7,623,482	19,776	0.26	24,077	0.82
Ontario	12,666,029	12,641,497	24,532	0.19	41,363	0.59
Manitoba	1,176,754	1,182,731	-5,977	-0.51	6,469	-0.92
Saskatchewan	987,799	991,490	-3,691	-0.37	4,805	-0.77
Alberta	3,358,106	3,408,975	-50,869	-1.49	16,091	-3.16
British Columbia	4,296,271	4,235,151	61,120	1.44	16,591	3.68
Yukon	31,150	32,177	-1,027	-3.19	194	-5.29
Northwest Territories	42,227	43,084	-857	-1.99	236	-3.63
Nunavut	30,316	30,738	-422	-1.37	176	-2.40

Table 13.1
Error of closure of the population estimates, Canada, provinces and territories, 2001 to 2021

Geography	Postcensal estimate	Census adjusted	Error of closure	Error of closure	CNU standard	t value ³
	on Census Day	for CNU ¹			error ²	
	A	B	C=A-B	D=C/B*100	E	F=C/E
	number		percent		number	
2001						
Canada	31,016,117	30,966,063	50,054	0.16	44,749	1.12
Newfoundland and Labrador	533,707	522,331	11,376	2.18	1,782	6.38
Prince Edward Island	138,098	136,619	1,479	1.08	775	1.91
Nova Scotia	941,548	932,528	9,020	0.97	4,170	2.16
New Brunswick	754,177	749,593	4,584	0.61	3,555	1.29
Quebec	7,390,018	7,390,359	-341	0.00	21,033	-0.02
Ontario	11,873,903	11,862,355	11,548	0.10	33,472	0.35
Manitoba	1,149,562	1,150,596	-1,034	-0.09	5,423	-0.19
Saskatchewan	1,016,758	1,000,745	16,013	1.60	4,333	3.70
Alberta	3,051,252	3,049,641	1,611	0.05	11,308	0.14
British Columbia	4,068,158	4,072,543	-4,385	-0.11	15,598	-0.28
Yukon	29,735	30,097	-362	-1.20	372	-0.97
Northwest Territories	41,151	40,655	496	1.22	362	1.37
Nunavut	28,050	28,001	49	0.17	411	0.12

1. Census net undercoverage includes the incompletely enumerated reserves and settlements.

2. The standard error of census net undercoverage excludes the incompletely enumerated reserves and settlements.

3. An error of closure with a t value greater than 1.96 or less than -1.96 is statistically significant at the 95% confidence level.

Source: Statistics Canada, Centre for Demography.

Table 13.2
Error of closure of the estimates of population by age and gender, 2021, Canada

	Total - Gender		Men+		Women+	
	number	percent	number	percent	number	percent
All ages	-41,269	-0.11	-65,227	-0.34	23,958	0.12
0 to 4 years	-14,297	-0.75	-5,806	-0.60	-8,491	-0.91
5 to 9 years	-28,133	-1.36	-17,558	-1.65	-10,575	-1.05
10 to 14 years	-23,858	-1.13	-23,494	-2.16	-364	-0.04
15 to 19 years	-190	-0.01	-8,485	-0.80	8,295	0.83
20 to 24 years	46,224	1.92	29,691	2.37	16,533	1.43
25 to 29 years	-37,936	-1.42	-23,304	-1.68	-14,632	-1.14
30 to 34 years	-10,011	-0.37	-5,771	-0.42	-4,240	-0.32
35 to 39 years	10,315	0.39	514	0.04	9,801	0.75
40 to 44 years	-5,926	-0.24	-15,377	-1.23	9,451	0.76
45 to 49 years	-3,754	-0.16	-4,952	-0.42	1,198	0.10
50 to 54 years	-1,582	-0.07	2,742	0.23	-4,324	-0.35
55 to 59 years	1,108	0.04	-2,522	-0.19	3,630	0.27
60 to 64 years	-12,744	-0.49	-9,718	-0.76	-3,026	-0.23
65 to 69 years	5,458	0.25	1,283	0.12	4,175	0.37
70 to 74 years	-116	-0.01	-2,916	-0.33	2,800	0.29
75 to 79 years	13,455	1.07	4,337	0.73	9,118	1.37
80 to 84 years	699	0.08	2,598	0.70	-1,899	-0.41
85 to 89 years	6,463	1.24	5,643	2.70	820	0.26
90 to 94 years	3,613	1.42	4,188	4.95	-575	-0.34
95 to 99 years	6,977	9.79	2,761	15.71	4,216	7.86
100 years and older	2,966	28.48	919	50.89	2,047	23.77

Source: Statistics Canada, Centre for Demography.

Glossary

Age

Age refers to the age of a person as of July 1.

Aging (of a population)

Aging refers to an increase in the number of older persons as a percentage of the total population.

Average age

Average age represents the average age of members of a given population.

Census agglomeration (CA)

Census agglomeration (CA) refers to a region formed by one or more adjacent municipalities centred on a population centre (known as the core). A CA must have a core population of at least 10,000 based on data from the previous Census of Population Program. To be included in the CA, other adjacent municipalities must have a high degree of integration with the core, as measured by commuting flows derived from data on place of work from the previous Census Program.

If the population of the core of a CA falls below 10,000, the CA is retired from the next census. All areas inside the CA that are not population centres are rural areas.

When a CA has a core of at least 50,000, based on data from the previous Census of Population, it is subdivided into census tracts. Census tracts are maintained for the CA even if the population of the core subsequently falls below 50,000.

Census coverage

Coverage errors occur when people or dwellings are omitted, counted more than once, or incorrectly counted (i.e., they should not have been counted in the census). Coverage studies are conducted to measure the misclassification of dwellings and the undercoverage or overcoverage of people.

Census division (CD)

Census division (CD) refers to the general term for provincially legislated areas (such as county, municipalit  regionale de comt  and regional district) or their equivalents. Census divisions are intermediate geographic areas between the province level and the municipality (census subdivision).

In Newfoundland and Labrador, Manitoba, Saskatchewan, Alberta, Yukon, Northwest Territories and Nunavut, provincial or territorial law does not provide for these administrative geographic areas. Therefore, Statistics Canada, in cooperation with these provinces and territories, has created equivalent areas called census divisions for the purpose of disseminating statistical data. In Yukon, the census division is equivalent to the entire territory.

Census family

Census family refers to a married couple and the children, if any, of either and/or both spouses; a couple living common law and the children, if any, of either and/or both partners; or a parent of any marital status in a one-parent family with at least one child living in the same dwelling and that child or those children. All members of a particular census family live in the same dwelling. Children may be biological or adopted children regardless of their age or marital status as long as they live in the dwelling and do not have their own married spouse, common-law partner or child living in the dwelling. Grandchildren living with their grandparent(s) but with no parents present also constitute a census family.

Census metropolitan area (CMA)

Census metropolitan area (CMA) refers to a region formed by one or more adjacent municipalities centred on a population centre (known as the core). A CMA must have a total population of at least 100,000 of which 50,000 or more must live in the core. To be included in the CMA, other adjacent municipalities must have a high degree of integration with the core, as measured by commuting flows derived from census place of work data.

Once an area becomes a CMA, it is retained as a CMA even if its total population declines below 100,000 or the population of its core falls below 50,000. Small population centres with a population count of less than 10,000 are called fringe. All areas inside the CMA that are not population centres are rural areas.

All CMAs are subdivided into census tracts.

The CMA of Ottawa-Gatineau (Ontario-Quebec) crosses provincial boundaries. When the geographic level selected is all of Canada, the totals include the CMA on both sides of the provincial border. If a province has been selected, only the part of the CMA in the province chosen is included in the totals.

Census net undercoverage (CNU)

Represents the number of persons excluded from the census who should have been enumerated (undercoverage) less the number of extra enumerations of persons who were enumerated more than once (overcoverage).

Census net undercoverage rate

Census net undercoverage rate refers to the difference between the census undercoverage rate and the census overcoverage rate.

Census overcoverage

Refers to either including persons who should not have been enumerated or enumerating persons more than once.

Census overcoverage rate

Census overcoverage rate refers to the ratio of the number of persons who should not have been counted in the census or who were counted more than once to the total number of persons that should have been enumerated in the census. Generally, the rate is expressed in percentage.

Census subdivision (CSD)

Census subdivision (CSD) refers to municipalities (as determined by provincial or territorial legislation) or areas treated as municipal equivalents for statistical purposes (for example, Indian reserves, Indian settlements and unorganized territories).

Census undercoverage

Refers to excluding persons who should have been enumerated.

Census undercoverage rate

Census undercoverage rate refers to the ratio of the estimated number of persons not enumerated in the census (who were intended to have been enumerated) to the total number of persons that should have been enumerated in the census. Generally, the rate is expressed in percentage.

Census undercoverage study (CUS)

Census undercoverage study, formerly called the Reverse Record Check (RRC) until the 2021 Census, refers to one of three studies which provide estimates of census coverage error, including independent estimates of census

undercoverage and overcoverage. The CUS begins by working with a sample of all persons who were enumerated (or missed) in the previous census, along with all persons who were either born or entered Canada over the intercensal period. Except for a very small sub-population of returning emigrants, the CUS sampling frame includes all persons who could potentially be part of the census target universe.

Cohort

Cohort refers to a group of persons who have experienced a specific demographic event during a given year. In the case of births, persons born within a specified year are referred to as a generation.

Cohort component method

Cohort component method refers to the method used to produce estimates by age and gender, whereby the population is aged from year to year, and the components of demographic change are organized according to age and gender cohorts.

Component method

Component method refers to the method of generating population estimates which uses the components of demographic change and a base population as the input.

Components of demographic growth

Components of demographic growth refers to all demographic events (births, deaths and migrations) that influence the size or the age and gender composition of the population.

Death

Death refers to the permanent disappearance of all evidence of life at any time after a live birth has taken place. Stillbirths are excluded from death estimates in the Demographic Estimates Program.

Demographic dependency ratio

Demographic dependency ratio represents the ratio of the combined population aged from 0 to 14 years old and the population aged 65 years and older to the population aged from 15 to 64 years old. The ratio is purely demographic in nature and does not consider disability, employment or socio-economic status. A higher ratio might suggest that the economic activity, revenues, and taxes from the core working-age population helps support services for a larger group of people.

Demographic estimate program

Demographic estimate program refers to Statistics Canada's statistical program that provides estimates of population and components of population growth for Canada, the provinces and territories, and several sub-provincial and sub-territorial areas.

Population estimates are essential for determining the amounts of transfer payments made by the federal government to the provinces and territories, under the Federal-Provincial Fiscal Arrangements and Federal Post-Secondary Education and Health Contributions Act, and the Canada Student Loans Act. These data are also used to calculate demographic, social and economic indicators, and to determine annual immigration levels by the Government of Canada.

Demographic growth rate or population growth rate

Demographic growth rate or population growth rate refers to the ratio of population growth between the year t and $t+1$, to the average population of both these years.

Economic region (ER)

Economic region (ER) refers to a grouping of complete census divisions (with one exception in Ontario) created as a standard geographic unit for analysis of regional economic activity.

Within the province of Quebec, economic regions (“régions administratives”) are designated by law. In all other provinces or territories, economic regions are created by agreement between Statistics Canada and the provinces or territories concerned. Prince Edward Island and the three territories each consist of one economic region. In Ontario, there is one exception where the economic region boundary does not respect census division boundaries: the census division of Halton is split between the ER of Hamilton–Niagara Peninsula and the ER of Toronto.

Emigrant

Emigrant refers to Canadian citizen or immigrant who has left Canada to establish a residence in another country, involving a change in usual place of residence. Emigrant may be either long-term or short-term.

Error of closure

Error of closure represents the difference between the postcensal estimate at the census date and the results of the census adjusted for census net undercoverage (including adjustment for incompletely enumerated reserves and settlements).

Gender

Gender refers to an individual’s personal and social identity as a man, woman or non-binary person (a person who is not exclusively a man or a woman).

Gender includes the following concepts:

- Gender identity, which refers to the gender that a person feels internally and individually;
- Gender expression, which refers to the way a person presents their gender, regardless of their gender identity, through body language, aesthetic choices or accessories (e.g., clothes, hairstyle and makeup), which may have traditionally been associated with a specific gender.

A person’s gender may differ from their sex at birth, and from what is indicated on their current identification or legal documents such as their birth certificate, passport or driver’s licence. A person’s gender may change over time.

Some people may not identify with a specific gender.

Gender ratio

Gender ratio represents the ratio of the number of men+ to the number of women+. This ratio is usually expressed as an index, with the number of women+ taken to be a base of 100.

Generation

Generation refers to a group of persons born within a given period. For example, the 2006 generation represents people born during the year 2006.

Household

Household refers to a person or group of persons who occupy the same dwelling and do not have a usual place of residence elsewhere in Canada or abroad. The dwelling may be either a collective dwelling or a private dwelling. The household may consist of a family group such as a census family, of two or more families sharing a dwelling, of a group of unrelated persons or of a person living alone. Household members who are temporarily absent on reference day are considered part of their usual household.

Immigrant

Immigrant refers to a person who is a permanent resident (landed immigrant). Such a person has been granted the right to live in Canada permanently by immigration authorities. Persons who are born abroad to a Canadian parent are not immigrants but are included in the returning emigrant component.

Incompletely enumerated reserves and settlements

Incompletely enumerated reserves and settlements refers to census subdivisions for which enumeration either was not permitted or could not be completed for various reasons, such as evacuations because of forest fires or access restrictions due to the COVID-19 pandemic.

Internal migration

Internal migration represents all movements of persons within Canada's geographical boundaries, involving a change in usual place of residence. Internal migration denotes movement from one province or territory to another (i.e., interprovincial migration) and movements from some other smaller defined geographical unit to another (i.e., intraprovincial migration).

International migration

International migration represents movement of population between Canada and a foreign country which involves a change in the usual place of residence. A distinction is made with regard to immigrants, emigrants, returning emigrants and net non-permanent residents.

Interprovincial migration

Interprovincial migration represents all movements from one province or territory to another involving a change in the usual place of residence. A person who takes up residence in another province or territory is an out-migrant with reference to the province or territory of origin and an in-migrant with reference to the province or territory of destination.

Intraprovincial migration

Intraprovincial migration represents all movement from one region to another within the same province or territory involving a change of the usual place residence. A person who takes up residence in another region is an out-migrant with reference to the region of origin and an in-migrant with reference to the region of destination.

Live Birth

Live birth refers to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached.

Long-term emigrant

Long-term emigrant refers to a Canadian citizen or landed immigrant who has left Canada to take up long-term residence in another country.

Long-term returning emigrant

Long-term returning emigrant refers to a Canadian citizen or landed immigrant who has already emigrated from Canada on a long-term basis and subsequently returned to live in Canada.

Median age

Median age represents an age “x”, such that exactly one half of the population is older than “x” and the other half is younger than “x”.

Men+

Men+ refers to the gender category which includes men (and/or boys), as well as some non-binary persons.

Natural increase

Natural increase refers to the variation in population size between two dates resulting from the difference between the numbers of births and deaths.

Net emigration

Net emigration represents the result of the following formula: Emigrants - Returning emigrants. For estimates from 1991 to June 2016, net emigration represents the result of the following formula: Emigrants + Net temporary emigration - Returning emigrants.

Net internal migration

Net internal migration represents the sum of net intraprovincial and net interprovincial migration.

Net international migration

Net international migration represents the result of the following formula: Immigrants + Net non-permanent residents – Net emigration.

Net interprovincial migration

Net interprovincial migration represents the difference between in-migrants and out-migrants for a given province, territory or subprovincial region.

Net intraprovincial migration

Net intraprovincial migration represents the difference between in-migrants and out-migrants for a given region.

Net non-permanent residents

Net non-permanent residents represents the variation in the number of non-permanent residents between two dates. It is calculated by taking the difference between the inflows and outflows of non-permanent residents between two dates for a given region.

Net temporary emigration

Net temporary emigration represents the variation in the number of temporary emigrants between two dates for demographic estimates from 1991 to June 2016. Temporary emigration includes Canadian citizens and immigrants living temporarily abroad who have not maintained a usual place of residence in Canada. From July 2016, net temporary emigration is distributed among emigrants and returning emigrants.

Non-permanent resident

Non-permanent resident refers to a person from another country with a usual place of residence in Canada and who (1) has claimed refugee status (asylum claimants, protected persons and related groups) or (2) holds a work permit, a study permit, or a temporary resident permit.

Family members living with permit holders are also included unless these family members are already Canadian citizens, landed immigrants (permanent residents), or non-permanent residents themselves.

Non-permanent residents, inflows

Non-permanent residents, inflow refers to the number of people claiming asylum or entering as work, study and temporary resident permit holders in Canada. This number also includes the family members living with permit holders who are not Canadian citizens, landed immigrants (permanent residents) or non-permanent residents themselves.

Non-permanent residents, outflows

Non-permanent residents, outflow refers to the number of work, study and temporary resident permit holders leaving Canada, along with their family members who are not Canadian citizens, landed immigrants (permanent residents) or non-permanent residents themselves.

This also includes permit holders and asylum claimants, protected persons and related groups staying in Canada who have been granted permanent resident status. In this case, these persons will be added to the immigrant component.

Asylum claimants and related groups who have been deported are also counted as outflows.

Non-permanent resident type

Non-permanent resident type refers to the temporary residence status for which a non-permanent resident has been authorized to enter Canada. This category is defined according to the type(s) of permit(s) and/or refugee claim valid on given date. The non-permanent resident types are mutually exclusive and are derived in the following order of classification:

1. Asylum claimants, protected persons and related groups;
2. Permit holders and their family members.

Consequently, there are no asylum claimants, protected persons and related groups among the permit holders and their family members.

1. Asylum claimants, protected persons and related groups

Asylum claimants, protected persons and related groups are defined as:

- Asylum claimant refers to a foreign national who has made a refugee claim while in Canada on a temporary basis and whose claim is pending decision.
- Protected person refers to a person who has made a claim in Canada and received a positive decision. For Statistics Canada's Demographic Estimates Program, protected persons leave this population if they obtain permanent residence.
- Related groups include those who received a negative decision or withdrew or abandoned their claim and have not yet regularized their status or departed Canada.

This type includes the following subtypes:

- **Asylum claimants, protected persons and related groups with work permit only**
 - ▶ Asylum claimants, protected persons and related groups who only have a work permit. A work permit is a document issued by Immigration, Refugees and Citizenship Canada that authorizes a person to work on a temporary basis in Canada.
- **Asylum claimants, protected persons and related groups with study permit only**
 - ▶ Asylum claimants, protected persons and related groups who only have a study permit. A study permit is a document issued by Immigration, Refugees and Citizenship Canada that authorizes a person to study at a designated learning institution in Canada.

- **Asylum claimants, protected persons and related groups with work and study permits**
 - ▶ Asylum claimants, protected persons and related groups who have both a work and study permit at the same time.
- **Asylum claimants, protected persons and related groups without work or study permits**
 - ▶ Asylum claimants, protected persons and related groups with a valid claim but neither a work nor study permit.

2. Permit holders and their family members

Permit holders and their family members are non-permanent residents who are not asylum claimants, protected persons and related groups, but who hold a permit (for work, study or temporary residence). This classification also includes their family members who are not Canadian citizens, landed immigrants (permanent residents) or non-permanent residents themselves. This type includes the following subgroups:

- **Work permit holders only**
 - ▶ Non-permanent residents who only have a work permit. A work permit is a document issued by Immigration, Refugees and Citizenship Canada that authorizes a person to work on a temporary basis in Canada. This subtype does not include family members.
- **Study permit holders only**
 - ▶ Non-permanent residents who only have a study permit. A study permit is a document issued by Immigration, Refugees and Citizenship Canada that authorizes a person to study at a designated learning institution in Canada. This subtype does not include family members.
- **Work and study permit holders**
 - ▶ Non-permanent residents who have both a work and study permit at the same time. This subtype does not include family members.
- **Other**
 - ▶ “Other” mainly refers to family members living with permit holders, unless these family members are already Canadian citizens, landed immigrants, or non-permanent residents themselves. This type of non-permanent resident also refers to holders of other permits (e.g. temporary resident permits, formerly known as “Minister’s Permits”).

Population

Population represents the estimated population and includes the same persons as those in the census population universe.

Population estimate

- **Censal:** Refers to the enumerated population adjusted for the net census undercount and partially enumerated reserves and settlements. The censal estimate by age and gender can also include a demographic adjustment.
- **Postcensal:** Refers to the population estimate produced by using data from the most recent available census adjusted for census net undercoverage (including adjustment for incompletely enumerated reserves and settlements) and estimate of the components of demographic growth since that last census. This estimate can be preliminary, updated or final.
- **Intercensal:** Refers to the population estimate derived by using postcensal estimates and data adjusted for census net undercoverage (including adjustment for incompletely enumerated reserves and settlements) of censuses preceding and following the year in question.

Population growth or total growth

Population growth, or total growth, represents a variation of population size between two dates. It can also be obtained by summing the natural increase, total net migration and if applicable, adding residual deviation. It can be positive or negative.

Population universe

Population universe refers to the Census target population, also used by the Demographic Estimates Program at Statistics Canada, includes the following groups:

- Canadian citizens and landed immigrants (permanent residents) with a usual place of residence in Canada
- Canadian citizens and landed immigrants (permanent residents) who are abroad, either on a military base or attached to a diplomatic mission
- Canadian citizens and landed immigrants (permanent residents) at sea or in port aboard merchant vessels under Canadian registry or Canadian government vessels
- Non-permanent residents with a usual place of residence in Canada:
 - ▶ Who are claiming refugee status (asylum seekers)
 - ▶ Who hold a study permit (valid on reference date)
 - ▶ Who hold a work permit (valid on reference date) and family members living with them.

The 2021 Census population universe does not include foreign residents, but since 1991, it has included non-permanent residents.

Precocity error

Precocity error represents the difference between preliminary and final estimate in terms of its relative proportion of the total population for a given geographical area. It can be calculated for either population estimates or components of demographic growth.

Rate

Rate refers to the ratio of the number of events estimated in a year (t , $t+1$) to the average populations at the beginning and the end of the period. In this regard, births, deaths, immigration rates, etc. are calculated.

Residual deviation

Residual deviation represents the difference between demographic population growth calculated using intercensal estimates of population between two dates and that obtained by the sum of the components for the same period. This deviation results from the distribution of the error of closure (based on the number of days) over the five-year period.

Returning emigrant

Returning emigrant refers to a Canadian citizen or immigrant who has previously emigrated from Canada and subsequently returned to the country. Returning emigrant may be either long-term or short-term.

Sex at birth

Sex at birth refers to sex assigned at birth. Sex at birth is typically assigned based on a person's reproductive system and other physical characteristics.

Sex at birth may also be understood as the sex recorded at a person's birth (for example, what was recorded on their birth certificate).

Short-term emigrant

Short-term emigrant refers to a Canadian citizen or landed immigrant who has left Canada to take up short-term residence in another country.

Short-term returning emigrant

Short-term returning emigrant refers to a Canadian citizen or landed immigrant who has already emigrated from Canada on a short-term basis and subsequently returned to live in Canada.

Sprague coefficients

Sprague coefficients represent a series of factors which, when multiplied to a population distributed by multiples age groups, give a distribution of the same population by single years of age.

Stillbirth (fetal death)

Stillbirth refers to the death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles. Only fetal deaths where the product of conception has a birth weight of 500 grams or more or the duration of pregnancy is 20 weeks or longer are registered in Canada.

Total net migration

Total net migration represents the sum of net international and net internal migration.

Usual place of residence

Usual place of residence in Canada refers to the main dwelling in which the person lives most of the time. It is used to identify the person as a member of a particular household and, potentially, family (depending on the composition of the household).

Vital statistics

Vital statistics refers to all the demographic events (births, deaths, marriages and divorces) for which there is a legal requirement to inform the Provincial or Territorial Registrar's Office.

Women+

Women+ refers to the gender category which includes women (and/or girls), as well as some non-binary persons.

Year

Year refers to the period beginning July 1 of a given year and ending June 30 of the following year, unless otherwise specified.