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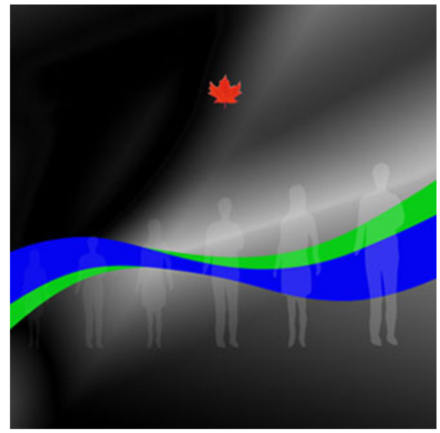
Population Projections for Canada (2021 to 2068), Provinces and Territories (2021 to 2043): Technical Report on Methodology and Assumptions



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Population Projections for Canada (2021 to 2068), Provinces and Territories (2021 to 2043)

Technical Report on Methodology and Assumptions

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1 - Introduction

Population projections for Canada and the provinces and territories are traditionally produced every five years, closely following the availability of adjusted population estimates based on the latest five-year census. However, in order to reflect recent developments in Canadian demographic trends – including rising immigration targets and the occurrence of the COVID-19 pandemic – this edition precedes the production of the 2021 census-based adjusted estimates. Partly borrowing from the assumptions of the previous edition, *Population Projections for Canada (2018 to 2068), Provinces and Territories (2018 to 2043): Technical Report on Methodology and Assumptions*[1] (hereinafter CCPT2018) as well as the long-term targets collected in the "*2018 Expert Survey of Future Demographic Trends*",[2] these projections use a 2021 base population, as estimated by Statistics Canada's Population Estimates Program.

This document describes the projection assumptions underlying the projections as well as the various projection scenarios proposed. It focuses on the many changes made since the publication of CCPT2018. However, the technical report of the previous edition[1] remains a useful reference for understanding how long-term targets are set in the various projection assumptions.

The results of the "Population Projections for Canada (2021 to 2068), Provinces and Territories (2021 to 2043)" (hereinafter CCPT2021) are available in two tables in the Common Exit Data Warehouse: 17-10-0057-01 (population counts) and 17-10-0058-01 (population growth components). They can also be accessed using a new interactive data visualization tool (Statistics Canada catalogue number 71-607-X-2022015). A short analytical report is also available (Statistics Canada catalogue number 91-520-X-2022001).

Notes for Section 1 - Introduction

[1] Statistics Canada. 2019. *Population Projections for Canada (2018 to 2068), Provinces and Territories (2018 to 2043): Technical Report on Methodology and Assumptions*. Catalogue number 91-620. https://www150.statcan.gc.ca/n1/pub/91-620-x/91-620-x2019001-eng.htm

[2] Dion, P., N. Galbraith and E. Sirag. 2020. "Using Expert Elicitation to Build Long-Term Projection Assumptions". In Mazzuco, S. and N. Keilman (editors). *Developments in Demographic Forecasting*. The Springer Series on Demographic Methods and Population Analysis. Volume 49. Springer, Cham. https://doi.org/10.1007/978-3-030-42472-5_3

2 - Assumptions and selection of scenarios

The purpose of having multiple projection scenarios is to reflect the uncertainty associated with the future. The projection scenarios are constructed by combining a number of assumptions regarding the future evolution of each of the components of population growth.

The six medium-growth scenarios (M1, M2, M3, M4, M5 and M6) were developed on the basis of assumptions reflecting different internal migration patterns observed in the past. Each scenario puts forward a separate assumption to reflect the volatility of this component.

The low-growth (LG) and high-growth (HG) scenarios bring together assumptions that are consistent with either lower or higher population growth than in the medium-growth scenarios at the Canada level. For example, assumptions that entail high fertility, low mortality, high immigration, low emigration and high numbers of non-permanent residents are the foundation of the high-growth scenario.

The fast-aging (FA) and slow-aging (SA) scenarios bring together assumptions that are consistent with either faster or slower population aging than in the medium-growth scenarios. For example, assumptions that entail high fertility, high mortality, high immigration, low emigration and high numbers of non-permanent residents are the foundation of the slow-aging scenario.

The ten scenarios are intended to provide a plausible and sufficiently broad range of projected numbers to take account of the uncertainties inherent in any projection exercise. Note that in the low-growth (LG), high-growth (HG), slow-aging (SA) and fast-aging (FA) scenarios, the interprovincial migration assumption is the same as the one used in the M1 medium-growth scenario. Projection assumptions and scenarios are summarized in Tables 2.1 and 2.2.

Table 2.1
Summary of the projection scenarios

Scenario	Fertility	Mortality	Immigration	Emigration, returning emigration and temporary emigration	Non-permanent residents	Internal migration
M1	Medium	Medium	Medium	Medium	Medium	Recent trends (2018/2019 to 2020/2021) transitioning linearly in 10 years to long term trends (1991/1992 to 2016/2017)
M2						1995/1996 to 2010/2011
M3						2003/2004 to 2008/2009
M4						2009/2010 to 2016/2017
M5						2014/2015 to 2016/2017
M6						2018/2019 to 2020/2021
LG	Low	High	Low	High	Low	Recent trends (2018/2019 to 2020/2021) transitioning linearly in 10 years to long term trends (1991/1992 to 2016/2017)
HG	High	Low	High	Low	High	
SA	High	High	High	Low	High	
FA	Low	Low	Low	High	Low	

Notes: LG (low growth), HG (high growth), SA (slow aging) and FA (fast aging).
Source: Statistics Canada, Centre for Demography.

Table 2.2
Summary of long-term projection scenario assumptions

Component	Scenario									
	Low growth	Medium growth						High growth	Slow aging	Fast aging
	LG	M1	M2	M3	M4	M5	M6	HG	SA	FA
Fertility (period total fertility rate) 2042/2043	1.40	1.59						1.79		1.40
Immigration (rate per thousand) 2042/2043	6.5	8.3						12.0		6.5
Life expectancy at birth Males 2042/2043	82.6 years	83.7 years						84.8 years	82.6 years	84.8 years
Life expectancy at birth Females 2042/2043	86.6 years	87.4 years						88.2 years	86.6 years	88.2 years
Interprovincial migration (reference period)	Recent trends (2018/2019 to 2020/2021) transitioning linearly in 10 years to long term trends (1991/1992 to 2016/2017)		1995/1996 to 2010/2011	2003/2004 to 2008/2009	2009/2010 to 2016/2017	2014/2015 to 2016/2017	2018/2019 to 2020/2021	Recent trends (2018/2019 to 2020/2021) transitioning linearly in 10 years to long term trends (1991/1992 to 2016/2017)		
Non-permanent residents (cumulative change from 2022 to 2043)	0	536,500						926,800		0
Emigration (gross migraproduction rate per thousand) 2042/2043	2.3	1.7						1.1		2.3
Return emigration (gross migraproduction rate per thousand) 2042/2043	1.3	1.0						0.6		1.3
Net temporary emigration (gross migraproduction rate per thousand) 2042/2043	0.7									

Note: The scenarios M2, M3, M4, M5 and M6 were created in order to reflect distinct interprovincial migration assumptions in comparison with scenario M1. For more details, see the Section 3.6 on internal migration.

Source: Statistics Canada, Centre for Demography.

3 - Description of assumptions

3.1 - Projection of fertility

The period total fertility rate (TFR) has been steadily decreasing in recent years. From 1.69 children per woman in 2008, it declined to 1.47 in 2019. Then in 2020, the TFR saw the largest year-over-year decline since 2008 to 1.40 children per woman. Finally, data for Quebec and British Columbia show that between December 2020 and February 2021, the number of births was well below the number observed at the same time the previous year.[1] [2]

The decrease in PTFR is a continuation of the trend observed for nearly 13 years. Various factors such as the postponement of the age at maternity, economic considerations, evolving values in the face of the family or difficulties in accessing adequate housing could be involved.[3] However the decrease observed in 2020 and 2021 is likely also due in part to the COVID-19 pandemic. Border closures during the first few months of the pandemic may also have had an impact by reducing the number of people entering the country and having a child soon after arrival. Several countries such as Italy and France experienced a decline in the number of births a few months after the beginning of the pandemic.[4] Studies show that in times of great uncertainty, people tend to avoid making significant changes to their lives, such as the decision to have a child.[5][6] The results of the *Canadian Social Survey – COVID-19 and Well-being* conducted between April and June 2021 echo these findings by showing that nearly 19% of people aged 15 to 49 now wanted to have fewer children or wanted to postpone the arrival of a child due to the pandemic, while only 4% wanted to have more children or a child earlier than expected.[7]

In the past, epidemics, cataclysms or wars have often caused a decline in fertility in the short term, followed by a longer-term recovery.[8] In Canada, recent data show that the decline in fertility caused by the pandemic may have been very short-lived and that the recovery may already be well underway. Indeed, from March to December 2021, the number of births in Quebec and British Columbia surpassed that of the previous year, so that in total there were more births in 2021 than in 2020, and as many as in 2019.[1] [2] Ontario saw a 0.9% increase in births in the first quarter of 2021 compared to 2020.[9] These results are consistent with those observed in France and the United States, where there were large rebounds in the number of births.[10] [11]

Three distinct fertility assumptions are proposed using the method used in CCPT2018. Specifically, the approach proposes an extrapolation of recent trends (2009 to 2019) rapidly converging towards long-term targets based on the results of the "*2018 Expert Survey of Future Demographic Trends*".[3] Note that because it potentially reflects the effects of the pandemic, the year 2020 was intentionally omitted from the estimation of recent trends.

Based on the medium assumption, Canada's PTFR will reach 1.39 in 2021/2022, decrease slightly to 1.37 in 2024/2025, and then climb steadily to reach the target of 1.59 in 2042/2043. The high fertility assumption assumes a substantial rebound in fertility from 2021/2022 with a PTFR of 1.49, and a constant increase towards a target set at 1.79 in 2042/2043. Finally, the low fertility assumption assumes that the PTFR will decrease to 1.28 in 2027/2028 and then rise to reach the target of 1.40 set in 2042/2043. Taking as a starting point the low level of the PTFR estimated in 2020/2021 (1.40) and assuming a continuation of recent downward trends as well as the potential effects of the pandemic, this assumption is a downward revision of the low fertility assumption proposed in the CCPT2018.[3]

Table 3.1.1
Period total fertility rate, Canada, provinces and territories, historic (2020) and projected (2043) according to the low, medium and high fertility assumptions[1]

Region	Historic (2020)	Projected (2043)		
		Low	Medium	High
	children per woman			
Canada[2]	1.40	1.40	1.59	1.79
Newfoundland and Labrador	1.26	1.26	1.43	1.58
Prince Edward Island	1.33	1.34	1.52	1.72
Nova Scotia	1.24	1.25	1.42	1.64
New Brunswick	1.42	1.43	1.62	1.77
Quebec	1.52	1.53	1.73	1.91
Ontario	1.34	1.34	1.52	1.73
Manitoba	1.61	1.62	1.84	2.17
Saskatchewan	1.78	1.79	2.03	2.23
Alberta	1.51	1.51	1.72	1.93
British Columbia	1.17	1.18	1.34	1.50
Yukon[3]	1.55	1.36	1.55	1.74
Northwest Territories	1.64	1.65	1.87	2.14
Nunavut	2.72	2.73	3.10	3.35

1. The 2020 data are considered preliminary.
2. The calculation for Canada in 2020 excludes Yukon.
3. Data on births that occurred in Yukon or to residents of Yukon in other provinces or territories are not available for years after 2016. Therefore, the period total fertility rate for Yukon for 2020 is actually 2016.

Sources: Statistics Canada, Canadian Vital Statistics, Births Database and Centre for Demography.

Notes for Section 3.1 - Projection of fertility

[1] Institut de la Statistique du Québec. 2022. *Naissances, décès et mariages par mois et par trimestre, Québec, 2010-2022*. Table accessed March 23, 2022. https://statistique.quebec.ca/fr/document/naissances-deces-et-mariages-par-mois-et-par-trimestre-quebec/tableau/naissances-deces-et-mariages-par-mois-et-par-trimestre-quebec

[2] BC Stat. 2022. *Births by Community Health Service Area*. Tables accessed March 23, 2022. https://www2.gov.bc.ca/gov/content/life-events/statistics-reports/births

[3] Galbraith, N., P. Dion and E. Sirag. 2019. "Chapter 3: Projection of fertility". In Statistics Canada. 2019. *Population Projections for Canada (2018 to 2068), Provinces and Territories (2018 to 2043): Technical Report on Methodology and Assumptions*. https://www150.statcan.gc.ca/n1/pub/91-620-x/91-620-x2019001-eng.htm

[4] Wall Street Journal, 2021. *The Covid-19 Baby Bust Is Here*. March 4. https://www.wsj.com/articles/the-covid-19-baby-bust-is-here-11614853803

[5] Sobotka, T., V. Skirbekk and D. Philipov. 2011. "Economic recession and fertility in the developed world". *Population and Development Review*. Volume 37, number 2.

[6] Alderotti, G., D. Vignoli, M. Baccini and A. Matysiak. 2019. "Employment Uncertainty and Fertility: A Network Meta-Analysis of European Research Findings". *Econometrics Working Papers Archive*. 2019_06. Universita' degli Studi di Firenze, Dipartimento di Statistica, Informatica, Applicazioni "G. Parenti".

[7] Fostik, A. and N. Galbraith. 2021. "Changes in fertility intentions in response to the COVID-19 pandemic". *Statcan COVID-19: Data to Insights for a better Canada*. Statistics Canada catalogue number 45-28-0001.

[8] Aassve, A., N. Cavalli, L. Mencarini, S. Plach and M. Livi Bacci. "The COVID-19 pandemic and human fertility". *Science*. Volume 369, number 6502, pages 370 to 371.

[9] Government of Ontario. 2022. *Ontario Demographic Quarterly: Highlights of first quarter*. Accessed March 23, 2022. https://www.ontario.ca/page/ontario-demographic-quarterly-highlights-first-quarter

[10] Institut national de la statistique et des études économiques. 2022. *Les naissances par mois en 2021 et 2022*. Accessed March 23, 2022. https://www.insee.fr/fr/statistiques/6041515?sommaire=5348638

[11] Kearney, M.S. and P.B. Levine. 2022. "The US COVID-19 Baby Bust and Rebound". *National Bureau of Economic Research Working Paper*. Series 30000. https://www.nber.org/papers/w30000

3.2 - Projection of mortality

Since 2019 – when mortality assumptions were last published in CCPT2018 – significant changes to trends in Canadian mortality have necessitated the revision and refinement of both the mortality projections methodology and the short- and long-term mortality assumptions. Most notably, the COVID-19 pandemic has led to an elimination of the gains in life expectancy at birth observed between 2018 and 2019 in Canada following a period of relative stagnation between 2016 and 2018. At the national level, life expectancy at birth for both sexes declined by 0.57 years between 2019 and 2020, in contrast to the increase of 0.38 years experienced between 2018 and 2019.[1] A similar outcome was observed among most of the provinces and territories, with the magnitude of the decline largely dependent upon the severity of the pandemic's impact in each given region – a phenomenon which can be measured by comparing differences in excess mortality[2] observed in 2020 across the provinces and territories. The only exceptions to this general trend have been New Brunswick and Nova Scotia, who both experienced increases in life expectancy during this period, and Prince Edward Island and Nunavut, where the most recent life expectancy estimates for 2020 are computed by averaging estimates from 2018/2020.[3]

As of July 2, 2022, the Public Health Agency of Canada (PHAC) has a reported a total of 41,932 COVID-19-releated deaths between 2020 and 2022, with approximately 63% of those deaths occurring between 2021 and 2022.[4] PHAC additionally reported a 96% increase in the number of opioid toxicity deaths in the months between the spring of 2020 and the spring of 2021 compared to the same period a year prior, with the bulk of this increase driven by British Columbia, Alberta, and Ontario.[5] Both of these factors, in addition to other potential collateral impacts of the pandemic such as reduced access to health care services resulting from lockdowns, for example, may have led to the decrease in life expectancy observed throughout this period. Assumptions on projected age-specific mortality rates for 2021 and 2022 must thus reflect the resulting shifts in age-specific mortality trends.

Similarly, mortality assumptions for 2023 onward must be adjusted to account for the potential short- and long-term impacts of pandemic-related changes in mortality. While the impact of COVID-19 and its collateral effects on long-term life expectancy cannot yet be known, revised assumptions should at minimum consider the possibility of a prolonged return to the "norm"; i.e. the life expectancy trajectory anticipated in a pre-pandemic setting. Both the Office for National Statistics (ONS) in the United Kingdom[6] and the National Institute of Statistics and Economic Studies (INSEE) in France[7] recently released population projections for 2021 onward with mortality assumptions revised to reflected changes induced by the pandemic.

Discrepancies in the impact of the pandemic on mortality across the provinces and territories also highlight the need to accurately quantify the sex-and region-specific uncertainty associated with projections of mortality. As with the last set of projections in CCPT2018, the modified Lee-Li (2005)[8] extension of the Lee-Carter (1992)[9] model is used to produce sex- and province/territory-coherent projections of age-specific mortality, but the manner in which low and high assumptions are constructed have been modified so as to incorporate the uncertainty inherent at various stages of the multi-step Lee-Li model.

3.2.1 Methodology

Much of the methodology remains largely unchanged from the last publication of population projections for Canada. Refer to Chapter 4: Projection of Mortality in CCPT2018 for a detailed description of these methods. The changes made to the methodology are intended to improve the uncertainty associated with the projections so that the resulting low, medium, and high mortality assumptions reflect, as best as possible, the various underlying sources of uncertainty in the model.

The coherent Li-Lee model expresses the log of age-specific mortality rates as a function of age- and time-specific factors, in addition to region- and sex-specific factors that allow for coherence at the regional and sex levels:

$$\ln(m_{x,t,s,i}) = \mu_{x,s,i} + B_x * K_t + b_{x,s} * k_{t,s} + \beta_{x,s,i} * \kappa_{t,s,i} + \varepsilon_{x,t,s,i}$$

where x, t, s, i are indices representing age, time (in years), sex, and region, respectively. The group specific mortality rate is denoted by $m_{x,t,s,i}$, while $\mu_{x,s,i}$ represents the average of $\ln(m_{x,t,s,i})$ over time, $B_x * K_t$ represents the common factor applied to all sexes and regions, $b_{x,s} * k_{t,s}$ is the sex specific factor applied to all regions, $\beta_{x,s,i} * \kappa_{t,s,i}$ represents the sex-region specific factor for each sex and region combination, and $\varepsilon_{x,t,s,i}$ is the error term. In this edition, the model was fit to data from 1981 to 2018.[10]

At the national level, K_t can be thought of as the time-specific component that quantifies the average decrease in mortality observed over time across all ages. The B_x term represents the age-specific patterns of decline. The $k_{t,s}$, $b_{x,s}$, $\kappa_{t,s,i}$ and $\beta_{x,s,i}$ have similar interpretations, except applied at the sex- and region-specific levels. In the previous edition, each of the time-varying components were adjusted through an iteration process so that, for each year, the modelled life expectancy matched the observed life expectancy.

This choice effectively represents a tradeoff between the resulting fit of the log mortality rates, $\ln(m_{x,t,s,i})$, and life expectancy – the Li-Lee model minimizes error with respect the former, so iterating the time-specific factors to improve the fit of life expectancy may come at the expense of poorer fit.[11]

The impact of iteration on the overall fit can be assessed by computing what Li and Lee refer to as an explanation ratio – a measure that indicates how well the multi-stage coherent Li-Lee model fits for a specific sub-group (i.e. , each region-sex pairing).[12] Explanation ratios computed pre- and post-iteration of the $\kappa_{t,s,i}$ and $k_{t,s}$ for each of the sexes and the provinces and territories by sex demonstrated a non-negligible deterioration in fit. For this reason, only K_t was iterated so that modelled life expectancy at the national level was in line with historical values, but no such condition is imposed at the sex and region levels.

The method by which mortality rates are forecast has also been modified from the last projections. In the Li-Lee model, obtaining forecasts of age-specific mortality rates is done by applying time series models to the K_t, $\kappa_{t,s,i}$ and $k_{t,s}$. A random walk with drift (RWD) is fit to the K_t while an autoregressive model of order 1 (AR(1)) is fit to both the $\kappa_{t,s,i}$ and $k_{t,s}$. Refer to Chapter 4: Projection of Mortality in CCPT2018 for a description of the forecast equations used in the previous edition.

In a standard time-series forecasts, forecast variance is driven largely by the uncertainty in the errors (or error variance). Li and Lee (2005) remark that uncertainty in parameter estimation should also be taken into account, in order for the forecasted trajectories to more accurately reflect both sources of uncertainty. The resulting forecasts for the K_t, $\kappa_{t,s,i}$ and $k_{t,s}$ would then take the form of the following:

$$K_t = K_{t-1} + (d + SE(d))\varepsilon + e_t * \sigma, \quad e_t \sim N(0,1)$$

$$k_{t,s} = [c0_s + SE(c0_s)\gamma_0] + [c1_s + SE(c1_s)\gamma_1] * k_{t-1,s} + e_{t,s} * \sigma_{t,s}, \quad \mathrm{e}_{t,s} \sim N(0,1)$$

$$\kappa_{t,s,i} = [c0_{s,i} + SE(c0_{s,i})\gamma_{0,i}] + [c1_{s,i} + SE(c1_{s,i})\gamma_{1,i}] * k_{t-1,s,i} + e_{t,s,i} * \sigma_{t,s,i}, \quad \mathrm{e}_{t,s,i} \sim N(0,1)$$

Where d represents the drift term in the RWD; $c0_j$ and $c1$, are the AR(1) intercept and autoregressive parameter, respectively; and the final term in each of the equations, $e_{t,j} * \sigma_{t,j}$, represents the random error. The new additions are the $SE(\,.\,)$ terms, which denote the standard error of the respective estimates, and γ_0, γ_1, $\gamma_{0,i}$ and $\gamma_{1,i}$, which are independent standard normal random variables. This manner of incorporating the standard errors of the AR(1) and RWD parameters into the forecast equations ensures that the forecast variances are larger – reflecting two sources of uncertainty – while ensuring that the expected values remain unchanged.

3.2.2 Assumption building

Prediction intervals for life expectancy resulting from the Lee-Carter model are known to underestimate uncertainty.[13] [14] Consequently, low and high mortality assumptions in CCPT2018 were constructed with the use of additional information. Responses on variability of future life expectancy were taken from the *2018 Survey on Future Demographic Trends* and used to construct an 80% confidence band around projected life expectancy in 2043; this confidence band was then taken to be the low and high targets for life expectancy in 2043, with assumptions in other years constructed proportionally. This hybrid method has the advantage of combining model-based estimates (the medium assumption) with subjective ones (the trajectory of the low and high assumptions) in order to produce estimates that are capable of accounting for sources of uncertainty not observed in the model.

A consequence of this approach is that the trajectories of the low and high assumptions across both the sexes and the provinces and territories tend to follow similar paths, and that the relative distance of the low and high assumptions from the medium is approximately the same. However, both the overall fit of the modified Lee-Carter model and the uncertainty in parameter estimation varies widely among the provinces and territories by sex. Computation of sex- and region-specific explanation ratios, for example, demonstrates that the model accounts for a larger proportion of observed variation in some sex-region pairings than others. For the resulting assumptions in each sex-region pair to best reflect the uncertainty inherent in the modelling procedure for the specific region and sex in question, it is preferable to use sex- and region-specific information in the assumption building process.

A new stochastic approach of computing the low, medium, and high assumptions was developed that allows for more variation in the trajectories among the regions and sexes. The steps are described as follows:

1. Generate 1,000 independent simulations of K_t, $\kappa_{t,s,i}$ and $k_{t,s}$ using the forecast equations described in the previous section.
2. From these 1,000 simulations, compute 1,000 estimates of mortality rates at ages 0-110 and the resulting values of life expectancy.
3. Compute the median and 97% confidence interval in every year of the projection from the empirical distribution of life expectancy for each sex and region: these trajectories are taken to be the medium and low and high assumptions, respectively.
4. To obtain estimates of mortality rates that are consistent with the life expectancy assumptions, iterate the projected K_t (for each assumption, separately) so that in each simulation, projected life expectancy is consistent with that of the relevant assumption.
5. For each assumption, there are now 1,000 different values of age-specific mortality rates that result in the same value of life expectancy in each year. From the empirical distribution of these rates, take the median of these values to be final low, medium, and high assumptions.

The main implication of such a method is that the final assumption in each sex-region pairing reflects the uncertainty at each level: the variability associated with the time series forecast of K_t represents global (national) uncertainty, the variability associated with the forecast of $k_{t,s}$ represents sex-specific deviations, and the variability associated with the forecast of $\kappa_{t,s,i}$ represents sex- and region-specific deviations. Differences in the width of the band created by the low and high assumptions on life expectancy between the sex-region pairs are driven by differences in this last term.

While still coherent, resulting projections of life expectancy by sex and region differ more notably than in the previous edition. The new low and high assumptions propose more plausible ranges of life expectancy because they are based on probabilistic simulations specific to each sex and region. Overall variability is much greater in the territories, for example, due a combination of small population counts and a shorter historical series[15] used in the modelling procedure, resulting in a greater difference (in years) between the low and high assumptions than elsewhere.

3.2.3 COVID-19 ADJUSTMENT

Historical data from 2019 (2018/2020) were omitted from the model in order to prevent pandemic-era (2020-) data from impacting projected mortality rates. The inclusion of 2019 would lead to a downward level-shift in life expectancy in all assumptions without any catch-up in later years of the projection; while not implausible as an outcome, scenarios in which a return to the norm is observed should be considered, in addition to scenarios in which the speed of return varies. For this reason, assumptions were initially derived without consideration for the impact of the COVID-19 pandemic, with adjustments made to assumptions on mortality rates a posteriori.

Despite the important focus on mortality, it is changes to international migration in response to the pandemic that has most affected population growth in 2020.[16] Still, the pandemic could affect future population growth and the age structure of the population, depending on how the virus evolves in the future. This evolution is itself, however, rife with uncertainty. A commonly held belief among many researchers, immunologists and virologists is that SARS-CoV-2 will become endemic; that is, it will continue to circulate, but the number of infections will be relatively stable over time.[17] [18] Endemicity, however, does not mean that the virus becomes harmless; endemic diseases such as tuberculosis or malaria have killed over 2 million people in the world in 2020.[19] Furthermore, even if the virus enters an endemic phase, outbreaks may still occur in a fashion similar to what is currently observed with influenza, for example.[20]

To account for the potential impact of the pandemic on mortality in the future, two distinct stages, or magnitudes, of COVID mortality were conceived: a pandemic stage that plausibly reflects what could be expected in the first year of the projection (2021/2022) based on the data currently available, and an endemic stage that could plausibly represent the toll of the virus once it reaches endemicity. Distinct trajectories of COVID mortality – which consist of COVID age-specific mortality rates that are ‘added’ to the projected non-COVID mortality rates – were then built by designing transitions from the pandemic to the endemic stages.

The additive COVID adjustment factors for the pandemic stage were built in four steps:

1. COVID-19 death counts by region for 2021/2022 were estimated based on data from the Public Health Agency of Canada (PHAC) to obtain a recent measurement of the impact of the pandemic on mortality in each province and territory.[21] At the time of computation, about two-thirds of the 2021/2022 year had been observed. Observed death counts were increased by ten percent to account for the remaining one third, while also considering the fact that the death toll had been decreasing and that spring could further alleviate the toll.
2. A profile of COVID mortality by age and sex was computed for each province and territory. This was done by computing age- and sex-specific COVID death rates using data from Statistics Canada's Vital Statistics Death Database for the period June 1, 2020 to May 31, 2021.[22]
3. Profiles computed in Step 2 were smoothed based on Statistics Canada's three-year life tables for the period 2017/2019.[23]
4. COVID death rates by age and sex were calibrated to match the number of COVID deaths estimated for 2021/2022 in Step 1. For smaller regions, the COVID death rates are computed by taking an average of the region-specific rates and the national level rates.

Additive factors for the endemic stage were built by calibrating the COVID death rates by age and sex computed in Step 3 above to the average number of deaths attributed to Influenza between 2014 and 2020 at the national level. Thus, additive factors are identical in each region.

The COVID-19 age-specific death rates the pandemic stage represent a plausible outcome for the death toll directly associated with COVID in the first year (2021/2022) of the projection, whereas those computed for the endemic stage represent an ending point for the transition towards endemicity. The method adjusts age- and sex-specific mortality rates by province and territory in each of the three assumptions according to varying hypotheses placed upon the intensity of the pandemic's impact on short- and long-term mortality trends.

In the medium assumption, the projected 2021/2022 COVID-19 age-specific death rates are assumed to prevail throughout that period. In the second year of the projection, a mix of 50% of the 2021/2022 level and the endemic level is proposed. In following years, it is assumed that the virus will reach an endemic phase with impacts proportional to those of influenza in the past. Projected mortality rates will thus reflect the impact of COVID throughout the entire projection horizon.

In the low mortality assumption, the projected 2021/2022 COVID-19 age-specific death rates are applied at 75% only. This is to convey the potential positive impacts of behavioral changes induced by the pandemic and new public health measures, in particular to combat infectious diseases.[24] From 2023/2024 onward, the pandemic would have no more impact and the mortality rates would converge to what was projected in the original low mortality assumption.

Finally, the high assumption assumes that COVID mortality will be at the 2021/2022 level for the first two years of the projection. In 2023/2024, COVID mortality would be a mix (50%) of the 2021/2022 and endemic levels. From 2024/2025 to the end of the projection, COVID mortality would reach two times the endemic level, reflecting ongoing direct and indirect impacts of the pandemic, potentially aggravated by the onset of new virus strains.[25] [26]

3.2.4 Mortality Assumptions

In all three mortality assumptions, life expectancy at birth in all provinces is projected to increase, though at different rates, while the gap in life expectancy between males and females would continue to decrease. Projected life expectancy at birth by sex and province/territory for selected years according to the low, medium and high mortality assumptions are shown in tables 3.2.1, 3.2.2 and 3.2.3. Chart 3.2.1 shows both observed and projected life expectancy at birth at Canada level, for males and females separately, from year 1981 to 2068.

Assumptions on projected life expectancy at the national level were constructed by taking a weighted average of the mortality assumptions made at the province and territory level. The resulting range on life expectancy created by the low and high mortality assumptions at the national level are larger than what would be obtained had assumptions been made at the national level directly. This is due to the perfect correlation of the trajectories of life expectancy between the provinces and territories assumed under a given assumption.

Table 3.2.4.1

Life expectancy at birth, by sex, provinces and territories, historic (1984 to 2019) and projected according to the medium mortality assumption (2021/2022 to 2067/2068), for selected years or periods

Sex / Region	1984	1989	1994	1999	2004	2009	2014	2019	2021/ 2022	2026/ 2027	2031/ 2032	2036/ 2037	2041/ 2042	2046/ 2047	2051/ 2052	2056/ 2057	2061/ 2062	2066/ 2067	2067/ 2068
	in years																		
Males																			
Canada	72.9	73.9	74.9	76.3	77.6	78.9	79.8	79.8	80.3	81.4	82.2	82.9	83.6	84.3	84.9	85.6	86.2	86.7	86.9
N.L.	72.3	73.3	73.9	74.9	75.6	76.9	77.2	77.9	78.6	79.6	80.5	81.3	82.1	82.8	83.5	84.1	84.8	85.4	85.6
P.E.I.	72.6	73.0	74.1	75.1	76.9	77.6	79.0	79.8	79.8	80.5	81.1	81.8	82.5	83.1	83.8	84.4	85.0	85.7	85.8
N.S.	71.9	73.0	74.3	75.6	76.5	77.8	78.1	78.4	78.9	79.9	80.7	81.4	82.2	82.9	83.6	84.2	84.9	85.5	85.6
N.B.	72.4	73.6	74.4	75.3	76.8	77.9	78.7	78.7	78.9	80.0	80.8	81.5	82.3	83.0	83.7	84.3	84.9	85.5	85.7
Que.	71.9	73.0	74.1	75.5	77.3	79.0	80.1	80.8	81.1	82.1	82.8	83.5	84.1	84.7	85.3	85.9	86.5	87.0	87.1
Ont.	73.3	74.4	75.3	76.8	78.1	79.3	80.3	80.2	80.7	81.7	82.4	83.1	83.8	84.5	85.1	85.7	86.3	86.9	87.0
Man.	73.0	73.9	74.7	75.2	76.4	77.3	77.9	77.7	78.3	79.7	80.7	81.6	82.4	83.2	83.9	84.6	85.2	85.9	86.0
Sask.	73.7	74.5	75.1	75.6	76.5	76.9	77.8	77.7	78.4	79.9	80.8	81.8	82.6	83.4	84.1	84.8	85.5	86.2	86.3
Alta.	73.5	74.5	75.5	76.6	77.6	78.6	79.3	79.2	79.6	80.9	81.7	82.5	83.3	83.9	84.6	85.3	85.9	86.5	86.7
B.C.	74.0	74.8	75.7	77.4	78.5	79.7	80.5	79.9	80.5	81.5	82.4	83.1	83.9	84.6	85.2	85.9	86.5	87.1	87.2
Y.T.	69.2	71.0	70.5	73.4	74.7	74.5	76.0	..	77.1	78.9	79.8	80.8	81.6	82.5	83.3	84.0	84.7	85.4	85.6
N.W.T.	..	..	..	73.1	74.8	74.2	76.1	75.1	75.3	76.8	77.7	78.6	79.4	80.2	81.0	81.7	82.3	83.1	83.2
Nvt.	..	..	..	66.5	68.4	68.8	69.0	68.2	70.6	72.0	73.3	74.5	75.5	76.5	77.5	78.5	79.4	80.3	80.5
Females																			
Canada	79.7	80.5	80.9	81.6	82.4	83.3	83.9	84.1	84.5	85.4	86.0	86.7	87.3	87.8	88.4	88.9	89.4	89.9	90.0
N.L.	78.6	79.2	80.0	80.0	80.9	81.8	81.4	81.9	82.7	83.6	84.4	85.1	85.8	86.5	87.1	87.6	88.2	88.7	88.8
P.E.I.	80.1	80.9	80.8	80.7	81.7	83.1	83.4	83.7	84.0	84.7	85.3	86.0	86.6	87.2	87.7	88.2	88.7	89.2	89.3
N.S.	79.1	79.7	80.4	81.1	81.7	82.5	82.6	82.6	83.2	84.1	84.8	85.5	86.2	86.8	87.4	87.9	88.5	89.0	89.1
N.B.	79.8	80.5	80.9	81.4	82.2	82.8	83.0	82.9	83.4	84.3	85.0	85.7	86.4	87.0	87.5	88.1	88.6	89.1	89.2
Que.	79.5	80.3	80.8	81.6	82.4	83.3	83.9	84.3	84.7	85.6	86.2	86.8	87.4	87.9	88.5	89.0	89.5	89.9	90.0
Ont.	79.7	80.5	80.9	81.7	82.5	83.6	84.3	84.5	84.8	85.7	86.3	86.9	87.5	88.0	88.6	89.0	89.5	90.0	90.1
Man.	80.0	80.5	80.6	80.8	81.3	82.0	82.3	82.1	82.6	83.8	84.6	85.5	86.2	86.9	87.5	88.1	88.7	89.3	89.4
Sask.	80.5	81.3	81.6	81.4	81.9	82.2	82.5	82.6	83.1	84.3	85.1	85.9	86.6	87.3	87.9	88.5	89.1	89.7	89.8
Alta.	80.1	80.8	81.2	81.8	82.4	83.1	83.5	83.9	84.0	85.1	85.7	86.4	87.0	87.6	88.1	88.7	89.2	89.6	89.7
B.C.	80.6	81.0	81.4	82.4	83.0	83.9	84.7	84.9	85.2	86.0	86.6	87.2	87.8	88.3	88.8	89.3	89.8	90.3	90.4
Y.T.	75.2	77.1	77.8	78.4	80.0	79.5	81.2	..	81.8	83.2	84.0	84.8	85.5	86.2	86.8	87.5	88.1	88.6	88.8
N.W.T.	..	..	..	78.6	79.0	80.0	79.0	78.9	78.9	80.2	81.0	81.7	82.4	83.0	83.7	84.3	84.9	85.4	85.6
Nvt.	..	..	..	70.3	75.1	75.0	73.2	72.7	73.5	74.9	76.1	77.3	78.2	79.3	80.2	81.1	81.9	82.7	82.8

.. not available for a specific reference period

Notes: Statistics Canada produces life tables for a three-year reference period. For ease of reading, each stated year refers to the middle of the three-year period. For example, '2019' refers to the period 2018 to 2020. Historical data for the year 2020 (2019/2021) are not yet available and thus omitted from the table. The calculation for Canada for years 2016 to 2019 excludes Yukon. The numbers for Yukon in 2016 and onward are projected.

Sources: Statistics Canada. 2022. *Life Tables, Canada, Provinces and Territories*. Catalogue number 84-537 and Centre for Demography.

In Canada, life expectancy at birth for males is projected to increase from 79.8 years in 2019 to 83.7 years in 2043 and 86.9 years in 2068 under the medium mortality assumption. Under the high mortality assumption, male life expectancy is projected to reach 82.6 years in 2043 and 85.7 years in 2068. In contrast, male life expectancy would reach 84.8 years in 2043 and 87.9 years in 2068 under low mortality assumption.

Female life expectancy is projected to increase from 84.1 years in 2019 to 87.4 years in 2043 and 90.0 years in 2068 under the medium mortality assumption. Under the high mortality assumption, female life expectancy would reach 86.6 in 2043 and 89.1 years in 2068, in comparison to 88.2 and 90.8 years, respectively, in the low mortality assumption.

Table 3.2.4.2

Life expectancy at birth, by sex, provinces and territories, historic (1984 to 2019) and projected according to the low mortality assumption (2021/2022 to 2067/2068), for selected years or periods

Sex / Region	1984	1989	1994	1999	2004	2009	2014	2019	2021/ 2022	2026/ 2027	2031/ 2032	2036/ 2037	2041/ 2042	2046/ 2047	2051/ 2052	2056/ 2057	2061/ 2062	2066/ 2067	2067/ 2068
	in years																		
Males																			
Canada	72.9	73.9	74.9	76.3	77.6	78.9	79.8	79.8	81.1	82.1	83.0	83.8	84.6	85.3	86.0	86.6	87.2	87.8	87.9
N.L.	72.3	73.3	73.9	74.9	75.6	76.9	77.2	77.9	79.7	80.7	81.7	82.6	83.3	84.1	84.7	85.3	86.0	86.6	86.7
P.E.I.	72.6	73.0	74.1	75.1	76.9	77.6	79.0	79.8	80.6	81.4	82.0	82.8	83.4	84.1	84.8	85.4	86.0	86.5	86.6
N.S.	71.9	73.0	74.3	75.6	76.5	77.8	78.1	78.4	79.4	80.4	81.3	82.1	82.9	83.6	84.3	85.0	85.6	86.3	86.4
N.B.	72.4	73.6	74.4	75.3	76.8	77.9	78.7	78.7	79.5	80.6	81.4	82.2	83.0	83.7	84.4	85.1	85.7	86.4	86.5
Que.	71.9	73.0	74.1	75.5	77.3	79.0	80.1	80.8	81.9	83.0	83.8	84.6	85.3	86.0	86.6	87.1	87.8	88.4	88.4
Ont.	73.3	74.4	75.3	76.8	78.1	79.3	80.3	80.2	81.3	82.3	83.2	84.0	84.8	85.4	86.1	86.7	87.3	87.9	88.0
Man.	73.0	73.9	74.7	75.2	76.4	77.3	77.9	77.7	79.7	81.0	82.0	82.9	83.7	84.6	85.2	85.8	86.4	87.0	87.1
Sask.	73.7	74.5	75.1	75.6	76.5	76.9	77.8	77.7	80.0	81.3	82.4	83.3	84.2	84.9	85.7	86.3	86.9	87.4	87.6
Alta.	73.5	74.5	75.5	76.6	77.6	78.6	79.3	79.2	80.5	81.5	82.5	83.3	84.1	84.8	85.5	86.2	86.8	87.4	87.5
B.C.	74.0	74.8	75.7	77.4	78.5	79.7	80.5	79.9	81.1	82.1	83.0	83.8	84.6	85.3	86.0	86.6	87.3	87.9	88.0
Y.T.	69.2	71.0	70.5	73.4	74.7	74.5	76.0	..	78.7	79.9	81.1	81.9	82.9	83.7	84.5	85.3	86.1	86.8	86.9
N.W.T.	..	..	..	73.1	74.8	74.2	76.1	75.1	77.3	78.3	79.2	80.0	80.8	81.6	82.3	83.0	83.6	84.3	84.5
Nvt.	..	..	..	66.5	68.4	68.8	69.0	68.2	72.6	74.2	75.4	76.4	77.4	78.4	79.4	80.4	81.2	82.0	82.3
Females																			
Canada	79.7	80.5	80.9	81.6	82.4	83.3	83.9	84.1	85.1	86.0	86.7	87.4	88.1	88.6	89.2	89.7	90.2	90.7	90.8
N.L.	78.6	79.2	80.0	80.0	80.9	81.8	81.4	81.9	83.8	84.9	85.8	86.6	87.3	87.9	88.4	89.1	89.6	90.2	90.2
P.E.I.	80.1	80.9	80.8	80.7	81.7	83.1	83.4	83.7	84.5	85.3	86.0	86.7	87.3	87.9	88.5	89.0	89.6	90.0	90.1
N.S.	79.1	79.7	80.4	81.1	81.7	82.5	82.6	82.6	83.9	85.0	85.8	86.5	87.3	87.8	88.4	88.9	89.5	90.0	90.1
N.B.	79.8	80.5	80.9	81.4	82.2	82.8	83.0	82.9	84.2	85.1	85.8	86.6	87.2	87.8	88.4	88.9	89.5	90.0	90.1
Que.	79.5	80.3	80.8	81.6	82.4	83.3	83.9	84.3	85.2	86.0	86.7	87.4	88.0	88.6	89.1	89.7	90.2	90.7	90.8
Ont.	79.7	80.5	80.9	81.7	82.5	83.6	84.3	84.5	85.4	86.2	87.0	87.6	88.3	88.8	89.4	89.9	90.4	90.8	90.9
Man.	80.0	80.5	80.6	80.8	81.3	82.0	82.3	82.1	83.8	85.0	86.1	86.9	87.6	88.2	88.9	89.5	90.1	90.7	90.9
Sask.	80.5	81.3	81.6	81.4	81.9	82.2	82.5	82.6	84.3	85.5	86.4	87.3	88.1	88.8	89.5	90.1	90.6	91.1	91.2
Alta.	80.1	80.8	81.2	81.8	82.4	83.1	83.5	83.9	84.8	85.6	86.3	87.1	87.8	88.3	88.9	89.4	90.0	90.4	90.5
B.C.	80.6	81.0	81.4	82.4	83.0	83.9	84.7	84.9	85.7	86.4	87.1	87.8	88.4	89.0	89.5	90.0	90.5	91.0	91.0
Y.T.	75.2	77.1	77.8	78.4	80.0	79.5	81.2	..	82.8	83.9	84.7	85.6	86.4	87.2	87.9	88.6	89.2	90.0	90.1
N.W.T.	..	..	..	78.6	79.0	80.0	79.0	78.9	80.5	81.3	82.1	82.8	83.4	84.1	84.7	85.3	86.0	86.5	86.6
Nvt.	..	..	..	70.3	75.1	75.0	73.2	72.7	75.3	77.3	78.6	79.8	81.3	82.4	83.4	84.3	85.1	86.1	86.1

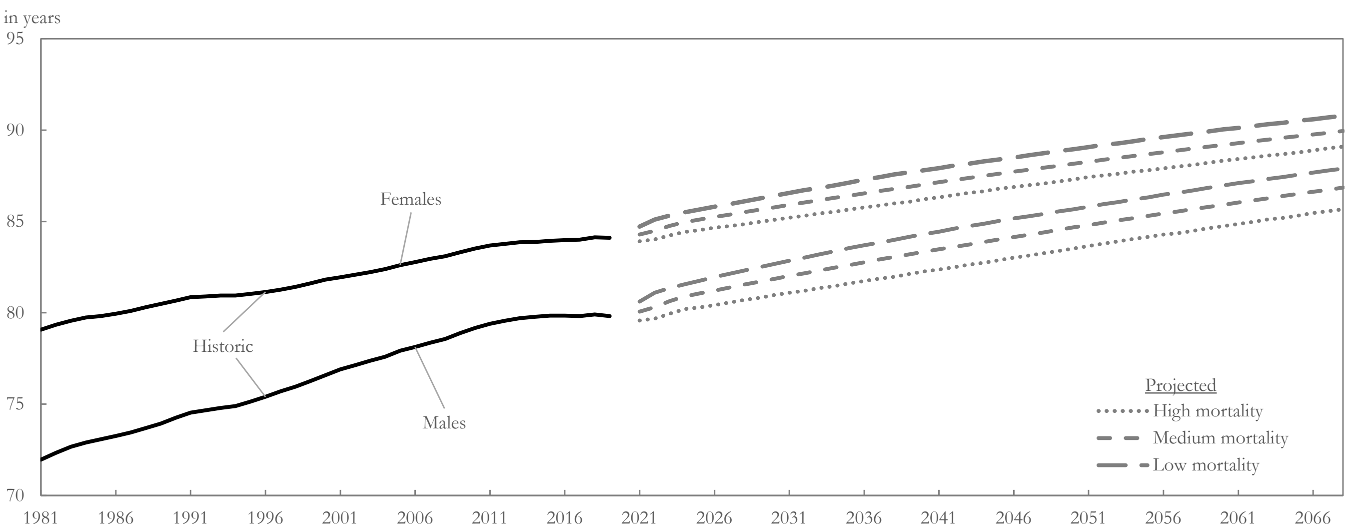
.. not available for a specific reference period

Notes: Statistics Canada produces life tables for a three-year reference period. For ease of reading, each stated year refers to the middle of the three-year period. For example, '2019' refers to the period 2018 to 2020. Historical data for the year 2020 (2019/2021) are not yet available and thus omitted from the table. The calculation for Canada for years 2016 to 2019 excludes Yukon. The numbers for Yukon in 2016 and onward are projected.

Sources: Statistics Canada. 2022. *Life Tables, Canada, Provinces and Territories*. Catalogue number 84-537 and Centre for Demography.

Chart 3.2.4.1

Life expectancy at birth, by sex, Canada, historic (1981 to 2019) and projected (2021 to 2068) according to the low, medium and high mortality assumptions



Notes: Statistics Canada produces life tables for a three-year reference period. For ease of reading, each stated year refers to the middle of the three-year period. For example, '2019' refers to the period 2018 to 2020. The calculation for Canada for 2017 onward excludes Yukon.

Source: Statistics Canada, Centre for Demography.

Table 3.2.4.3
Life expectancy at birth, by sex, provinces and territories, historic (1984 to 2019) and projected according to the high mortality assumption (2021/2022 to 2067/2068), for selected years or periods

Sex / Region	1984	1989	1994	1999	2004	2009	2014	2019	2021/ 2022	2026/ 2027	2031/ 2032	2036/ 2037	2041/ 2042	2046/ 2047	2051/ 2052	2056/ 2057	2061/ 2062	2066/ 2067	2067/ 2068
	in years																		
Males																			
Canada	72.9	73.9	74.9	76.3	77.6	78.9	79.8	79.8	79.7	80.6	81.2	81.9	82.5	83.1	83.8	84.4	85.0	85.6	85.7
N.L.	72.3	73.3	73.9	74.9	75.6	76.9	77.2	77.9	77.6	78.4	79.1	79.9	80.6	81.4	82.1	82.7	83.5	84.0	84.1
P.E.I.	72.6	73.0	74.1	75.1	76.9	77.6	79.0	79.8	78.9	79.3	79.9	80.5	81.2	82.0	82.7	83.3	84.0	84.7	84.8
N.S.	71.9	73.0	74.3	75.6	76.5	77.8	78.1	78.4	78.5	79.3	80.0	80.7	81.4	82.1	82.7	83.4	84.0	84.5	84.7
N.B.	72.4	73.6	74.4	75.3	76.8	77.9	78.7	78.7	78.4	79.4	80.1	80.8	81.5	82.2	82.9	83.5	84.1	84.6	84.8
Que.	71.9	73.0	74.1	75.5	77.3	79.0	80.1	80.8	80.4	81.1	81.6	82.2	82.7	83.3	84.0	84.4	85.0	85.6	85.7
Ont.	73.3	74.4	75.3	76.8	78.1	79.3	80.3	80.2	80.1	81.0	81.6	82.2	82.8	83.4	84.0	84.5	85.2	85.7	85.8
Man.	73.0	73.9	74.7	75.2	76.4	77.3	77.9	77.7	77.2	78.4	79.2	80.1	80.8	81.6	82.4	83.3	83.9	84.6	84.7
Sask.	73.7	74.5	75.1	75.6	76.5	76.9	77.8	77.7	77.1	78.3	79.1	79.8	80.8	81.7	82.4	83.2	83.9	84.6	84.7
Alta.	73.5	74.5	75.5	76.6	77.6	78.6	79.3	79.2	79.0	80.2	80.9	81.6	82.4	83.0	83.7	84.3	84.9	85.5	85.7
B.C.	74.0	74.8	75.7	77.4	78.5	79.7	80.5	79.9	80.0	80.9	81.6	82.4	83.0	83.7	84.4	85.0	85.6	86.2	86.3
Y.T.	69.2	71.0	70.5	73.4	74.7	74.5	76.0	..	75.5	77.6	78.5	79.4	80.2	80.9	81.8	82.6	83.3	83.9	84.2
N.W.T.	..	..	..	73.1	74.8	74.2	76.1	75.1	73.6	75.1	76.0	76.9	77.9	78.7	79.3	80.0	80.9	81.6	81.6
Nvt.	..	..	..	66.5	68.4	68.8	69.0	68.2	68.3	69.7	71.1	72.1	73.2	74.3	75.5	76.3	77.4	78.4	78.4
Females																			
Canada	79.7	80.5	80.9	81.6	82.4	83.3	83.9	84.1	84.0	84.7	85.3	85.9	86.4	87.0	87.5	88.0	88.5	89.0	89.1
N.L.	78.6	79.2	80.0	80.0	80.9	81.8	81.4	81.9	81.6	82.2	83.1	83.8	84.3	85.0	85.7	86.3	86.8	87.3	87.5
P.E.I.	80.1	80.9	80.8	80.7	81.7	83.1	83.4	83.7	83.4	84.0	84.6	85.1	85.8	86.3	86.9	87.4	87.8	88.4	88.4
N.S.	79.1	79.7	80.4	81.1	81.7	82.5	82.6	82.6	82.5	83.2	83.8	84.5	85.2	85.8	86.4	86.9	87.4	87.9	88.0
N.B.	79.8	80.5	80.9	81.4	82.2	82.8	83.0	82.9	82.7	83.4	84.2	84.9	85.5	86.0	86.6	87.1	87.7	88.2	88.4
Que.	79.5	80.3	80.8	81.6	82.4	83.3	83.9	84.3	84.3	85.0	85.6	86.1	86.7	87.2	87.8	88.2	88.7	89.2	89.3
Ont.	79.7	80.5	80.9	81.7	82.5	83.6	84.3	84.5	84.4	85.1	85.6	86.1	86.7	87.2	87.7	88.2	88.7	89.2	89.2
Man.	80.0	80.5	80.6	80.8	81.3	82.0	82.3	82.1	81.6	82.5	83.2	83.8	84.4	85.3	85.9	86.5	87.1	87.7	87.8
Sask.	80.5	81.3	81.6	81.4	81.9	82.2	82.5	82.6	82.0	82.9	83.4	84.2	84.8	85.4	86.1	86.7	87.4	88.0	88.1
Alta.	80.1	80.8	81.2	81.8	82.4	83.1	83.5	83.9	83.5	84.5	85.1	85.6	86.3	86.8	87.3	87.9	88.3	88.8	89.0
B.C.	80.6	81.0	81.4	82.4	83.0	83.9	84.7	84.9	84.8	85.4	86.0	86.6	87.2	87.6	88.1	88.6	89.1	89.6	89.7
Y.T.	75.2	77.1	77.8	78.4	80.0	79.5	81.2	..	81.3	82.6	83.2	83.8	84.5	85.1	85.8	86.4	86.9	87.5	87.6
N.W.T.	..	..	..	78.6	79.0	80.0	79.0	78.9	77.5	78.9	79.6	80.3	81.2	81.6	82.4	83.0	83.8	84.3	84.5
Nvt.	..	..	..	70.3	75.1	75.0	73.2	72.7	72.0	72.8	73.9	74.8	75.7	76.4	77.5	78.3	79.1	79.9	80.2

.. not available for a specific reference period

Notes: Statistics Canada produces life tables for a three-year reference period. For ease of reading, each stated year refers to the middle of the three-year period. For example, '2019' refers to the period 2018 to 2020. Historical data for the year 2020 (2019/2021) are not yet available and thus omitted from the table. The calculation for Canada for years 2016 to 2019 excludes Yukon. The numbers for Yukon in 2016 and onward are projected.

Sources: Statistics Canada. 2022. *Life Tables, Canada, Provinces and Territories*. Catalogue number 84-537 and Centre for Demography.

Notes for Section 3.2 - Projection of mortality

[1] Figures were taken from Statistics Canada's single-year life tables. The data can be found in *Table 13-10-0837-01: Life expectancy and other elements of the complete life table, single-year estimates, Canada, all provinces except Prince Edward Island*. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310083701

[2] Excess mortality, or excess deaths, is defined as the number of deaths above what would be expected in the absence of the COVID-19 pandemic. As a measure, it encompasses both indirect and direct effects of the pandemic on mortality. Statistics Canada releases estimates of excess mortality on a monthly basis.

[3] No single-year life tables are produced for Prince Edward Island, the Northwest Territories, Yukon, and Nunavut, and thus life expectancy in 2020 cannot be assessed on a single-year basis. Data for these regions can be found in *Table: 13-10-0140-01: Life expectancy and other elements of the abridged life table, three-year estimates, Prince Edward Island and the territories*.https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1310014001

[4] Estimates retrieved from PHAC's COVID-19 Epidemiology Update. Accessed July 8, 2022. https://health-infobase.canada.ca/covid-19/?stat=num&measure=deaths_total&map=pt#a2

[5] Estimates retrieved from PHAC's Opioid- and Stimulant-related Harms in Canada dashboard. Accessed July 8, 2022. https://health-infobase.canada.ca/substance-related-harms/opioids-stimulant

[6] Office for National Statistics. 2022. *National population projections, mortality assumptions: 2020-based interim - Office for National Statistics*. Accessed June 8, 2022. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/methodologies/nationalpopulationprojectionsmortalityassumptions2020basedinterim#:~:text=For%20the%202020%2Dbased%20interim%20national%20population%20projections%20(NPPs),2045%20and%20remain%20constant%20thereafter

[7] Institut national de la statistique et des études économiques. 2022. *Projections de population pour la France – Méthodes et hypothèses*. Accessed June 8, 2022. https://www.insee.fr/fr/statistiques/5893639

[8] Li, N. and R. Lee. 2005. "Coherent mortality forecasts for a group of populations: An extension of the Lee-Carter method". *Demography*. Volume 42, pages 575 to 594.

[9] Lee, R.D. and L. Carter. 1992. “Modeling and forecasting the time series of U.S. mortality”. *Journal of the American Statistical Association*. Volume 87, pages 659 to 671.

[10] Input data are computed based on three-year averages, with the middle of the year denoting the year interval. 2018 thus represents the period 2017/2019.

[11] This may become of particular concern when iterating at the sex- and region-specific levels. At all ages, it usually is the case that $B_x > 0$, since, as noted, K_t denotes mortality decline and B_x thus represents the age-specific magnitude of decline. Since all of the age-specific parameters are in possession of the same sign, there are no offsetting impacts on $\ln(m_{x,t,s,i})$ when the K_t are iterated. As Li and Lee (2005) note, however, the $b_{x,s}$ and $\beta_{x,s,i}$ represent group- and age-specific deviations in the patterns of mortality change from the aggregate population(s). For this reason, values may be both positive and negative, resulting in age-specific death rates that may, for example, increase at ages where $b_{x,s}$ or $\beta_{x,s,i}$ are positive and decrease at ages where they are negative.

[12] See equation (7) on page 579 in Li and Lee (2005) for how the explanation ratio can be computed for a specific subgroup.

[13] Liu, X. and W.J. Braun . 2010. “Investigating Mortality Uncertainty Using the Block Bootstrap”. *Journal of Probability and Statistics*. Pages 1 to 15. https://doi.org/10.1155/2010/813583

[14] Koissi, M.-C., A. Shapiro and G. Hognas . 2006. “Evaluating and Extending the Lee–Carter Model for Mortality Forecasting Confidence Interval”. *Insurance Mathematics and Economics*. Volume 38, number 1, pages 1 to 20.

[15] The historical series for Yukon begins in 1981 (as with the provinces) and begins in 1999 for both the Northwest Territories and Nunavut.

[16] Statistics Canada. 2021. “Canada’s population estimates, fourth quarter 2020”. *The Daily*. https://www150.statcan.gc.ca/n1/daily-quotidien/210318/dq210318c-eng.htm

[17] Phillips, N. 2021. “The coronavirus is here to stay - here’s what that means”. *Nature*. Volume 590, pages 382 to 384. https://www.nature.com/articles/d41586-021-00396-2

[18] Torjesen, I. 2021. “Covid-19 will become endemic but with decreased potency over time, scientists believe”. *BMJ*. Pages 372 to 494. http://dx.doi.org/10.1136/bmj.n494

[19] Katzourakis, A. 2022. “COVID-19: endemic doesn’t mean harmless”. *Nature*. Volume 601, page 485. https://doi.org/10.1038/d41586-022-00155-x

[20] Callaway, E. 2021. “Beyond Omicron: what’s next for COVID’s viral evolution”. *Nature*. Volume 600, pages 204 to 207. https://doi.org/10.1038/d41586-021-03619-8

[21] Owing to the fact that at the time of calculation, Statistics Canada did not yet have official COVID death counts for 2021.

[22] Information on the database can be found at the following link: https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=3233

[23] Using the TOPALS method developed by De Beer. The TOPALS method is a relational approach that smooths mortality rates based on an assumed relation between a suitable standard – a life table for a region, usually an aggregate, whose estimates are considered robust – and the region of interest (usually a sub-region) where data may be lacking or subject to limitations. See: De Beer, J. 2011. “A new relational method for smoothing and projecting age-specific fertility rates: TOPALS”. *Demography*. Volume 24, number 18 , pages 409 to 454.

[24] Vaupel, J.W., F. Villavicencio and M.-P. Bergeron-Boucher 2020. “Demographic perspectives on the rise of longevity”. *Proceedings of the National Academy of Sciences*. Volume 118, number 9. https://doi.org/10.1073/pnas.2019536118

[25] Office of the Superintendent of Financial Institutions Canada. 2021. “Mortality Projections for Social Security Programs in Canada”. *Actuarial Study No. 22*. Office of the Chief Actuary.

[26] Club VITA. 2021. *COVID-19 Longevity Scenarios: a bump in the road or a catalyst for change*. https://clubvita.ca/Collaboration/Content/pdf/Club_Vita_Canada_COVID-19_scenarios_paper_March_2021.pdf

3.3 - Projection of immigration

No component of demographic growth was more affected by the pandemic than permanent immigration, mainly because of border and travel restrictions. In 2020, population increase through international migration was over 80% lower than it was in 2019.[1] However, this situation was expected to be temporary, as IRCC aimed to welcome between 300,000 to 410,000 permanent residents in 2021 as specified in their 2021/2023 Multi-Year Levels Plan. International migration did bounce back in 2021, accounting for 87.4% of the country's population growth in 2021.[2] In the last three months of 2021, Canada welcomed 138,182 immigrants – a quarterly all-time high.[3] Several factors can explain the rebound after 2020, including easing of COVID-19-related border restrictions and new measures adopted by IRCC such as the *Temporary resident to permanent resident pathway*, which aimed at encouraging workers and students already in the country to become immigrants.[4]

IRCC has proposed increased levels of immigration in its 2022/2023 Multi-Year Levels Plan: 431,645 immigrants in 2022, 447,055 in 2023 and 451,000 in 2024.[2] IRCC also intends to continue to invest in a number of programs that could encourage regionalization of immigration such as the Atlantic Immigration Pilot, the Rural and Northern Immigration Pilot, the AgriFood Pilot, the Provincial Nominee Program, the Economic Mobility Pathways Pilot, and the forthcoming Municipal Nominee Program.[2] Over the third quarter of 2021, Canada also started to welcome people from Afghanistan following the recent crisis in the country.[5]

As in CCPT2018, assumptions about immigration are formulated in terms of a national immigration rate and distributions by age, sex, province and territory. The immigration rate evolves between 2021 and 2043 following the short- and long-term approaches described in Statistics Canada (2019).[6] Three assumptions relating to immigration are proposed: low, medium and high. These assumptions are very much inspired by those developed in CCPT2018, taking into account the targets of the most recent immigration plan published by IRCC to set short-term targets as well as the results of the "*2018 Expert Survey of Future Demographic Trends*" from a long-term perspective.

With respect to the low immigration assumption, the number of immigrants from 2022 to 2024 is the lower bound of the range of IRCC's immigration plan[2] published in 2022: 360,000 immigrants in 2022, 380,000 in 2023 and 390,000 in 2024. In 2024/2025, this number corresponds to an immigration rate of 9.9 immigrants per 1,000 population. For subsequent years, the low assumption assumes a gradual (logarithmic) decrease in the immigration rate measured in 2024/2025 to an immigration rate that reaches 6.5 immigrants per 1,000 population in 2042/2043. The medium and high assumptions were developed in a similar way. Under the medium assumption, the projected rates are developed to match the target numbers of the immigration plan published in 2022: 431,645 immigrants in 2022, 447,055 in 2023 and 451,000 in 2024. After 2024, the projected immigration rate decreases following a cubic interpolation to reach 8.3 immigrants per 1,000 population in 2042/2043. Under the high assumption, the rates correspond to the upper bound of the plan, i.e. 445,000 immigrants in 2022, 465,000 in 2023 and 475,000 in 2024, after which it is kept constant at 12.0 immigrants per 1,000 population until the end of the projection.

The experts' targets were obtained in a context where immigration was already on the rise, which means that the experts have, overall, expressed the opinion that the immigration rate would tend to return in the long term to a level closer to recent historical values. Nevertheless, compared to the assumptions of previous projections, the increase in immigration plan targets and increasingly evident labour needs[7] are making their mark by slowing convergence towards the long-term target in the medium assumption and maintaining the target of the high assumption at a level not reached in recent decades.

Table 3.3.1
Projected immigration rate (per thousand), Canada, (2021/2022 to 2067/2068) according to the low, medium and high immigration assumptions

Period	Assumption		
	Low	Medium	High
	per thousand		
2021/2022	11.5	12.5	12.6
2022/2023	9.6	11.4	11.8
2023/2024	9.9	11.5	12.0
2024/2025	9.9	11.4	12.0
2025/2026	9.1	11.4	12.0
2026/2027	8.6	11.3	12.0
2027/2028	8.3	11.1	12.0
2028/2029	8.0	11.0	12.0
2029/2030	7.8	10.8	12.0
2030/2031	7.7	10.6	12.0
2031/2032	7.5	10.3	12.0
2032/2033	7.4	10.1	12.0
2033/2034	7.2	9.9	12.0
2034/2035	7.1	9.6	12.0
2035/2036	7.0	9.4	12.0
2036/2037	6.9	9.1	12.0
2037/2038	6.9	8.9	12.0
2038/2039	6.8	8.7	12.0
2039/2040	6.7	8.6	12.0
2040/2041	6.6	8.4	12.0
2041/2042	6.6	8.4	12.0
2042/2043 to 2067/2068	6.5	8.3	12.0

Source: Statistics Canada, Centre for Demography.

The geographic distribution of immigrants was determined in two steps. In the first step, the proportion that each province and territory will receive in projected year 2021/2022 was computed based on available data for that year (only data for June 2022 were not available). These recent data show the impact of some programs such as the Atlantic immigration program, which is the permanent continuation of the Atlantic Immigration Pilot,[8] and the recent increase in the number of economic immigrants allowed to come to Nova-Scotia in 2022.[9] In a second step, target proportions for year 2026/2027 were determined using a forecast based on an exponential smoothing model with a soothing parameter value of 0.9. An exponential smoothing model provides a single forecast based on past observations, assigning weights that decrease exponentially decreasing over time.[10] With a parameter of 0.9, the weights decrease relatively fast, so the forecast is close to values observed in recent years. Experiments with the model based on historical values show that giving more weight to recent observations tends to minimize forecast errors. The model was fit to data for a period of ten years up to 2018/2019 to remove any impact of the COVID-19 pandemic. The target proportions are reached in 5 years (from 2021/2022 to 2026/2027) following a logarithmic curve that suggests quick convergence to the 2026/2027 values, after which the proportions remain unchanged. Finally, within each province or territory, the immigrants were distributed by age and sex according to proportions observed between 2011/2012 and 2020/2021. Historical data used in calculating the distribution of immigrants were adjusted using correction factors calculated using the Longitudinal Immigration Database (IMDB), reflecting the degree of divergence between an immigrant's destination as reported before entering Canada and the province or territory of residence where the immigrant lives in their first year in Canada.[11]

Table 3.3.2
Projected distribution of Canada's total immigrants by province and territory, 2021/2022 and 2026/2027

Province/Territory	2021/ 2022	2026/ 2027
	percent	
Newfoundland and Labrador	0.47	0.43
Prince Edward Island	0.58	0.58
Nova Scotia	2.33	1.77
New Brunswick	1.37	1.39
Quebec	11.02	13.14
Ontario	48.22	45.81
Manitoba	3.80	4.63
Saskatchewan	2.87	4.16
Alberta	11.02	13.64
British Columbia	18.10	14.28
Yukon	0.10	0.07
Northwest Territories	0.10	0.10
Nunavut	0.02	0.01

Source: Statistics Canada, Centre for Demography.

Notes for Section 3.3 - Projection of immigration

[1] Statistics Canada. 2021. "Canada's population estimates, fourth quarter 2020". *The Daily*. https://www150.statcan.gc.ca/n1/daily-quotidien/210318/dq210318c-eng.htm

[2] Immigration, Refugees and Citizenship Canada. 2021. *Annual Report to Parliament on Immigration*. Consulted March 9, 2022. https://www.canada.ca/content/dam/ircc/documents/pdf/english/corporate/publications-manuals/annual-report-2021-en.pdf

[3] Statistics Canada. 2022. *Quarterly Demographic Estimates, October to December 2021*. Accessed May 31, 2022. https://www150.statcan.gc.ca/n1/pub/91-002-x/91-002-x2021004-eng.htm

[4] Immigration, Refugees and Citizenship Canada. 2021. *News Release (April 14) - New pathway to permanent residency for over 90,000 essential temporary workers and international graduates*. Accessed May 31, 2022. https://www.canada.ca/en/immigration-refugees-citizenship/news/2021/04/new-pathway-to-permanent-residency-for-over-90000-essential-temporary-workers-and-international-graduates.html

[5] Immigration, Refugees and Citizenship Canada. 2022. *News Release (March 30) - Canada marks 10,000 arrivals of Afghan refugees*. Accessed June 1, 2022. https://www.canada.ca/en/immigration-refugees-citizenship/news/2022/03/canada-marks-10000-arrivals-of-afghan-refugees.html

[6] Statistics Canada. 2019. *Population Projections for Canada (2018 to 2068), Provinces and Territories (2018 to 2043): Technical Report on Methodology and Assumptions*. Catalogue number 91-620. https://www150.statcan.gc.ca/n1/pub/91-620-x/91-620-x2019001-eng.htm

[7] Immigration, Refugees and Citizenship Canada. 2022. *News release (February 14) - New immigration plan to fill labour market shortages and grow Canada's economy*. Accessed July 6, 2022. https://www.canada.ca/en/immigration-refugees-citizenship/news/2022/02/new-immigration-plan-to-fill-labour-market-shortages-and-grow-canadas-economy.html

[8] Immigration, Refugees and Citizenship Canada. 2022. *News Release (March 4) - Launching the Atlantic Immigration Program to drive economic growth and attract skilled workers*. Accessed July 5, 2022. https://www.canada.ca/en/immigration-refugees-citizenship/news/2022/03/launching-the-atlantic-immigration-program-to-drive-economic-growth-and-attract-skilled-workers.html

[9] Global News. 2022. *Ottawa allows Nova Scotia to welcome 40 per cent more economic immigrants in 2022*. June 16. Accessed July 4, 2022. https://globalnews.ca/news/8925432/ottawa-nova-scotia-immigration-2022-40-per-cent/#:~:text=The%20federal%20government%20is%20allowing%20Nova%20Scotia%20to,provincial%20Labour%2C%20Skills%20and%20Immigration%20Minister%20Jill%20Balser

[10] Hyndman, R.J. and G. Athanasopoulos. 2018. *Forecasting: principles and practice, 2nd edition*. OTexts. Melbourne, Australia. Accessed on July 5, 2022. https://otexts.com/fpp2/

[11] Bohnert, N., J. Chagnon and P. Dion. 2015. *Population Projections for Canada (2013 to 2063), Province and Territories (2013 to 2038): Technical Report on Methodology and Assumptions*. Statistics Canada catalogue number 91-620.

3.4 - Projection of emigration

3.4.1 Emigration

The pandemic has had a considerable impact on international migration in the world in 2020 and 2021. In Canada, restrictions placed on international borders contributed to substantial drops in the number of new immigrants and non-permanent residents entering the country.[1] [2] The number of emigrants has also dropped considerably since 2018/2019.[3] At the national level, the *gross migraproduction rate* (GMPR)[4] decreased from 1.11 per thousand in 2018/2019 to 0.69 per thousand in 2020/2021. However, that drop appears to be a continuation of a trend that started before the pandemic, beginning in 2016/2017. Prior to that period, emigration was relatively stable (averaging 1.58 per thousand in the ten-year period ending in 2015/2016).

It is expected that migration will return to previously observed historical levels when restrictions on migration eventually ease. However, some anticipate that a spike in migration, caused by an unmet demand from employers in receiving countries and unmet demand for migration in sending countries, could cause anti-immigrant sentiment and lead to the reintroduction of restrictive immigration policies – an outcome predicted on the basis of both theory and empirical evidence.[5] It is not clear to which extent this would affect migration flows from Canada in the long-term. Moreover, the pandemic may affect mobility not only through border restrictions, but also by modifying migration intentions in a post-pandemic world.[6] The contraction of most economies is likely to shift mobility patterns in the short- to mid-term. In Canada, labour shortages in many sectors could have a retention effect; this shortage could be a factor in explaining the decrease in the number of emigrants observed prior to the pandemic. Overall, these trends make the projection of future trends a perilous exercise. Moreover, there is always some uncertainty related to the accuracy in the most recent estimates of emigrants, as these get revised over the two years following their publications. This is a normal process where different sources are used for privileging timeliness or accuracy,[7] but this source of uncertainty may not be negligible given the large movements observed recently.

For all these reasons, the three distinct assumptions associated with emigration now propose an uncertainty interval that is larger in comparison to CCPT2018. All assumptions propose some rebound from the current low levels, and thus some attenuation of the effects of the pandemic and the preventive measures. The low-emigration assumption proposes a relatively slow rebound of the GMPR, taking 10 years to reach the long-term target, but leveling-up quickly at the start of the projection (modeled with a logarithmic curve suggesting a quick departure from current levels). The long-term target corresponds to the lowest historical value observed in pre-pandemic years, which is the value observed in 2018/2019. This assumption acknowledges potential effects of the pandemic that could slow down migration in the short- and mid-term (such as the occurrence of new variants) and the decrease observed in recent years before the pandemic. The high emigration assumption proposes a fast rebound to high values of GMPR in only five years. The projected GMPR values in 2026/2027 and onward correspond to those of the assumption proposed in CCPT2018.[8] The high assumption presents an alternative in which emigration rates tend to rise in the future and the effects of the pandemic vanish relatively quickly. The medium assumption has been conceived as a middle road between the two extremes that are the low and high assumptions, and simply corresponds to the mean of these assumptions. In contrast to CCPT2018, it suggests lower levels of emigration, especially in the first half of the projection, where there could be further impacts of the pandemic and a continuation of the downward trend observed in the period shortly prior.

Table 3.4.1.1
Estimates of the number of emigrants and returning emigrants, Canada, 2011/2012 to 2020/2021

Period	Emigrants	Returning emigrants
	number	
2011/2012	65,393	37,170
2012/2013	62,129	36,994
2013/2014	63,722	36,889
2014/2015	65,837	38,458
2015/2016	67,893	39,660
2016/2017	58,630	39,756
2017/2018	50,580	39,117
2018/2019	47,337	39,091
2019/2020	36,899	54,524
2020/2021	29,677	8,256

Note: The number of emigrants and returning emigrant are final up to 2018/2019, updated for 2019/2020 and preliminary for 2020/2021.

Source: Statistics Canada. *Table 17-10-0008-01. Estimates of the components of demographic growth, annual.*

3.4.2 Returning emigrants

Since the start of the pandemic, there has been large swings in the number of returning emigrants, with a large increase in 2019/2020 followed by a sizeable diminution in 2020/2021 (Table 3.4.1).[3] A plausible narrative is that Canadians were encouraged to return to the country at the onset of the pandemic. This, and the important slowdown in the number of emigrants, contributed then to reduce the pool of potential returning emigrants. Restrictions on travel could also have been a factor limiting returns.

The assumptions relative to returning emigrants in CCPT2021 are built in a similar fashion as in CCPT2018.[8] More specifically, the rates of returning emigration are built based on the ratio of returning emigrants to emigrants, a figure that tends to be stable over time. This is not surprising since a large proportion of returning emigrants are recent emigrants.[9]

The high number of returns in 2019/2020 and the low levels of emigration in 2020/2021 (based on historical comparisons) could result in a fairly small pool of Canadians abroad likely to return to Canada. For this reason, all assumptions related to the return of emigration start from the historical low recorded in 2020/2021, and then increase to higher levels in line with historical values. In the low assumption, the ratio of returning emigrants to emigrants projected for year 2030/2031 is set to be the same as in CCPT2018 for that year. The projected GMPR then remains the same for all subsequent years. Values of the GMPR for the first ten projected years are interpolated using a logarithmic curve, suggesting a relatively quick departure from the low current levels. In the high assumption, it is projected that the ratio of returning emigrants to emigrants would reach the levels proposed in CCPT2018 in five years, with a fast departure from the current levels in the first year of projections. The projected ratio remains identical those in CCPT2018 in the subsequent years. The medium assumption for return emigration simply consists of the average of the low and high assumptions.

3.4.3 Temporary emigration

Temporary emigrants are Canadian citizens or immigrants who are living abroad temporarily and no longer have a usual place of residence in Canada. Three distinct assumptions have been elaborated. These three assumptions have the same target GMPR (0.7 per thousand), that will, however, be reached at different times during the projection. This target corresponds to the average of the GMPR observed between 2006/2007 and 2015/2016 (the two most recent complete intercensal periods for which final data are available).

In the low assumption, the target GMPR (0.7 per thousand) is reached in 10 years, i.e., in 2030/2031. A logarithmic interpolation is used between the observed rate in 2020/2021 (0.1 per thousand) and the target rate, suggesting a rapid increase at the start of the projection. For the high assumption, a logarithmic interpolation is also used, but the target GMPR is instead reached in five years (2025/2026). As for the medium assumption, for each period the average between the low and high assumption is used.

Table 3.4.3.1
Projected migraproduction rates for the components of emigration, returning emigration and temporary emigration, Canada, provinces and territories, 2042/2043

Region	Low			Medium			High		
	Emigration	Returning emigration	Temporary emigration	Emigration	Returning emigration	Temporary emigration	Emigration	Returning emigration	Temporary emigration
	per thousand								
Canada	1.12	0.63	0.73	1.72	0.97	0.73	2.33	1.32	0.73
Newfoundland and Labrador	0.37	0.12	0.20	0.54	0.17	0.20	0.71	0.23	0.20
Prince Edward Island	0.53	0.17	0.27	0.71	0.22	0.27	0.89	0.28	0.27
Nova Scotia	0.49	0.29	0.45	0.96	0.57	0.45	1.44	0.85	0.45
New Brunswick	0.35	0.20	0.24	0.56	0.33	0.24	0.78	0.46	0.24
Quebec	0.71	0.40	0.48	1.13	0.63	0.48	1.56	0.86	0.48
Ontario	1.31	0.78	0.89	2.04	1.22	0.89	2.77	1.65	0.89
Manitoba	0.73	0.49	0.51	1.15	0.78	0.51	1.58	1.06	0.51
Saskatchewan	0.54	0.30	0.29	0.85	0.47	0.29	1.16	0.63	0.29
Alberta	1.19	0.70	0.74	1.81	1.05	0.74	2.43	1.41	0.74
British Columbia	1.71	0.86	1.11	2.57	1.30	1.11	3.43	1.73	1.11
Yukon	0.48	0.03	0.28	0.88	0.06	0.28	1.28	0.09	0.28
Northwest Territories	0.14	0.05	0.22	0.18	0.06	0.22	0.23	0.08	0.22
Nunavut	0.00	0.00	0.03	0.02	0.00	0.03	0.04	0.01	0.03

Source: Statistics Canada, Centre for Demography.

Notes for Section 3.4 - Projection of emigration

[1] Statistics Canada. 2020. "Canada's population estimates: Age and sex, July 1, 2020". *The Daily*. https://www150.statcan.gc.ca/n1/daily-quotidien/200929/dq200929b-eng.htm

[2] Statistics Canada. 2021. "Canada's population estimates: Age and sex, July 1, 2021". *The Daily*. September 29. https://www150.statcan.gc.ca/n1/daily-quotidien/210929/dq210929d-eng.htm

[3] Statistics Canada. *Table 17-10-0008-01. Estimates of the components of demographic growth, annual.*

[4] The GMPR, is defined as the sum of age-specific (from ages 0 to 110 and over) emigration rates. It can be interpreted as the number of emigrations an individual could expect to make over the course of his or her lifespan, were the current age-specific rates to apply, and assuming he or she survives to the oldest age group. The GMPR has the advantage of being impervious to changes in the age structure of the population (unlike the crude emigration rate for example).

[5] O'Brien, M.L. and M.A. Eger. 2021. "Suppression, spikes, and stigma: How COVID-19 will shape international migration and hostilities toward it". *International Migration Review*. Volume 55, number 3, pages 640 to 559. https://journals.sagepub.com/doi/10.1177/0197918320968754

[6] Martin, S. and J. Bergmann. 2021. "(Im)mobiity in the age of COVID-19". *International Migration Review*. Volume 55, number 3, pages 660 to 687. https://journals.sagepub.com/doi/10.1177/0197918320984104

[7] Statistics Canada. 2016. *Population and Family Estimation Methods at Statistics Canada*. Catalogue number 91-528.

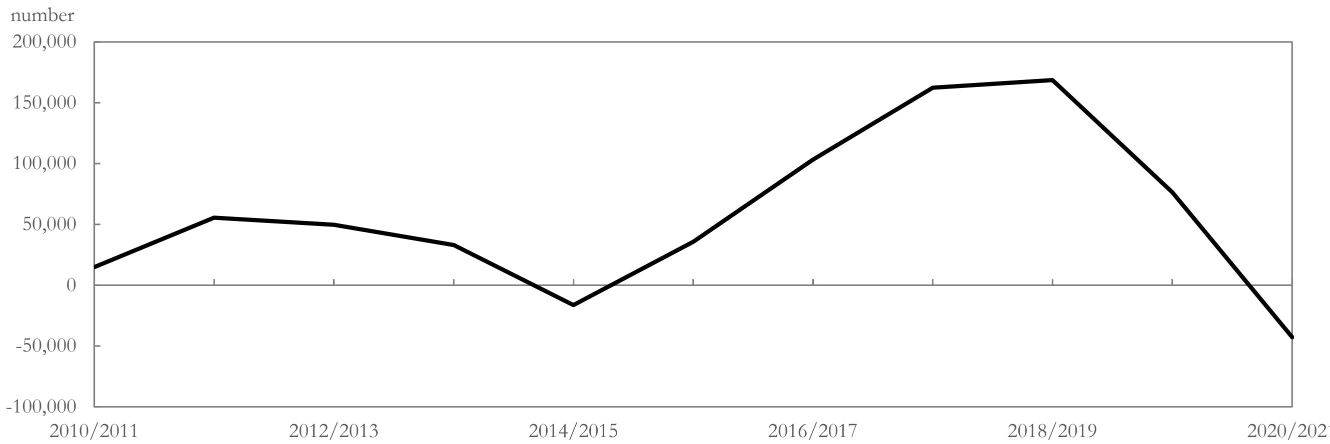
[8] Statistics Canada. 2019. *Population Projections for Canada (2018 to 2068), Provinces and Territories (2018 to 2043): Technical Report on Methodology and Assumptions*. Catalogue number 91-620. https://www150.statcan.gc.ca/n1/pub/91-620-x/91-620-x2019001-eng.htm

[9] For example, data from the service of Registration of Canadians Abroad, a service that enables the Government of Canada to contact and assist Canadians in case of an emergency while they are abroad, show that between 35% and 40% of returning Canadians had spent between 1 year or more but less than 2 years abroad. These results must however be taken with caution because the coverage of this database is only partial, given that there is no obligation to register to the database.

3.5 - Projection of non-permanent residents

The COVID-19 pandemic has greatly affected the flows of non-permanent residents in and out of the country. The number of non-permanent residents in Canada has been increasing substantially in recent years. 2020 saw a decline in the number of study or work permit holders. As a result, the net change in the number of non-permanent residents declined in 2019/2020 and 2020/2021 (Chart 3.5.1).

Chart 3.5.1
Annual change in the number of non-permanent residents, Canada, 2010/2011 to 2020/2021



Source: Statistics Canada. *Table 17-10-0008-01. Estimates of the components of demographic growth, annual.*

IRCC made substantial changes to its programs, facilitating admissions of international students and workers in sectors deemed essential or with urgent labour-market needs.[1] The number of study permit holders more than doubled between 2013 and 2019.[2] As per IRCC, in 2019, about 638,000 persons had a valid study permit (on December 31). That number declined to about 528,000 in 2020 but bounced back in 2021 to reach about 622,000. The numbers of permit holders under the International Mobility Program went from 305,000 to 242,000 in 2020, but reached 313,000 in 2021.[3] Likewise, the number of permit holders under the Temporary Foreign Workers program went from 98,000 in 2019 to 84,000 in 2020, and bounced back to 104,000 in 2021.[4]

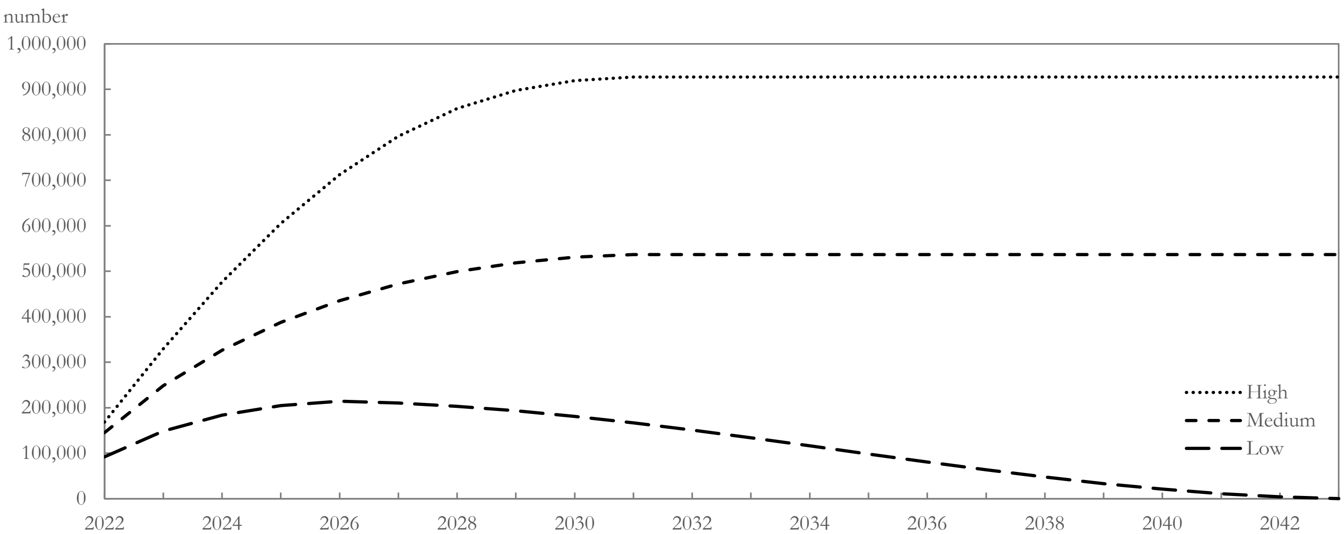
Starting in 2020, IRCC has adopted a number of temporary measures to alleviate barriers to non-permanent residents caused by the pandemic.[5] Additional measures have been taken to help address labour shortages across many sectors of the Canadian economy. These measures primarily affect foreign workers,[6] but to some degree students and visitors as well.[7] Finally, programs have also been designed to welcome Ukrainians fleeing the war.[8] All these measures have the potential to increase the number of non-permanent residents living in Canada in upcoming years, though it is difficult to accurately estimate their impact. Here are some examples of the recent measures taken:

- Starting in summer 2022, former international students in Canada having a post-graduation work permit expiring in 2022 will have the possibility of extending their work permit for up to 18 months.[7]
- In response to the invasion of Ukraine, the Canada-Ukraine authorization for emergency travel was designed as a special accelerated pathway to temporary residence in Canada.[8] Ukrainians and their immediate family members may stay in Canada as temporary residents for up to 3 years and are encouraged to apply for a 3-year open work permit at the same time as their visa application.
- Most measures affecting foreign workers are proposed under the Temporary Foreign Worker Program Workforce Solutions Road Map.[6] Some of these measures include:
    - Elimination of the limit in the number of low-wage positions that employers in seasonal industries can fill and an increase in the maximum duration for these positions from 180 days to 270 days per year.
    - Increase of the validity period for which labour market impact assessments are valid to 18 months (doubling).
    - Extension of the maximum duration of employment for High-Wage and Global Talent Streams workers (from two years to three years).
    - The cap on the proportion of low-wage temporary foreign workers an employer can hire doubles to reach 20%. In some (seven) sectors with demonstrated labour shortages, this cap reaches 30%.

The projection assumptions were built by first envisaging the net annual changes in the number of non-permanent residents at the national level. The number that each province and territory receives each year follows the distribution observed in the five-year period from 2017 to 2021. Within each province and territory, non-permanent residents are distributed by age and sex following the proportions also observed during the period 2017 to 2021. Three distinct assumptions are proposed: medium, low and high. They all suggest that the number of non-permanent residents will increase at the national level in the short-term.

In the medium assumption, the net annual change in the number of non-permanent residents starts at 145,000, which is the average observed in the three most recent years preceding the pandemic, from 2016/2017 to 2018/2019 (Chart 3.5.2). The net annual changes observed in these years represent a record high. The annual net change transitions to a net of zero in 10 years following a logarithmic curve, suggesting a fast decrease early in the projection and a slower one towards the end. From 2031/2032 onward, the projected net is zero and the number of non-permanent residents remains unchanged. This implies that for each non-permanent resident leaving the country or becoming an immigrant, another one is entering. Overall, the cumulative increase in the number of non-permanent residents reaches 536,500 in the medium assumption.

Chart 3.5.2
Projected cumulative change in the number of non-permanent residents, Canada, 2022 to 2043



Source: Statistics Canada, Centre for Demography.

The high assumption starts at a value of 168,500, the highest number observed in the years preceding the pandemic. This value, observed in 2018/2019, is also the highest one ever recorded. The annual net change transitions to a net of zero in 10 years following a cubic curve, suggesting a path that, compared to a linear one, decreases more slowly in the first half of the projection and faster in the second half. In the high assumption, there is a cumulative increase of 926,800 non-permanent residents.

The low assumption suggests that there will be an increase in the short-term, but that the cumulative change during the projected period will be nil. The low assumption starts with a net increase of 91,900, which is the average of the last 5 years (excluding 2020 and 2021). The projected net transitions to zero in 5 years. After that point, the net decreases so that the cumulative gains recorded in the projection reaches zero in 2043. In the low assumption, the number of non-permanent residents in 2043 is the same as at the start of the projection. However, the proportion that non-permanent residents represent in the population decreases (given that the Canadian population is projected to increase at a good pace).

Notes for Section 3.5 - Projection of non-permanent residents

[1] Griffith, A. 2022. *How the government used the pandemic to sharply increase immigration*. IRPP: April 25. Consulted June 24, 2022. https://policyoptions.irpp.org/magazines/april-2022/immigration-increase-pandemic/

[2] Immigration, Refugees and Citizenship Canada. 2022. *Canada - Study permit holders with a valid permit on December 31st by Province/Territory of intended destination and study level, 2000 –2021. Open Government dataset*. Consulted June 2, 2022. https://www.cic.gc.ca/opendata-donneesouvertes/data/EN_ODP_annual-TR-Study-IS_PT_study_level_year_end.xlsx

[3] Immigration, Refugees and Citizenship Canada. 2022. Canada - International Mobility Program work permit holders by gender, occupational skill level and year in which permit(s) became effective, January 2015 - March 2022. Open Government dataset. Consulted June 2, 2022. https://www.cic.gc.ca/opendata-donneesouvertes/data/IRCC_M_TR_0004_E.xlsx

[4] Immigration, Refugees and Citizenship Canada. 2022. *Canada - Temporary Foreign Worker Program work permit holders by gender, occupational skill level and year in which permit(s) became effective, January 2015 - March 2022. . Open Government dataset*. Consulted June 2, 2022. https://www.cic.gc.ca/opendata-donneesouvertes/data/IRCC_M_TR_0008_E.xlsx

[5] Immigration, Refugees and Citizenship Canada. 2021. *Annual Report to Parliament on Immigration*. Consulted March 9, 2022. https://www.canada.ca/content/dam/ircc/documents/pdf/english/corporate/publications-manuals/annual-report-2021-en.pdf

[6] Employment and Social Development Canada. 2022. *Backgrounder: Temporary Foreign Worker Program Workforce Solutions Road Map*. April 4. Consulted June 1, 2022. https://www.canada.ca/en/employment-social-development/news/2022/04/backgrounder-temporary-foreign-worker-programworkforce-solutions-road-map.html

[7] Immigration, Refugees and Citizenship Canada. 2022. *News release (April 22) - New measures to address Canada's labour*. Consulted June 24, 2022. https://www.canada.ca/en/immigration-refugees-citizenship/news/2022/04/new-measures-to-address-canadas-labour-shortage.html

[8] Immigration, Refugees and Citizenship Canada. 2022. *News Release (March 17) - Canada launches new temporary residence pathway to welcome those fleeing the war in Ukraine*. Consulted on June 1, 2022. https://www.canada.ca/en/immigration-refugees-citizenship/news/2022/03/canada-launches-new-temporary-residence-pathway-to-welcome-those-fleeing-the-war-in-ukraine.html

3.6 - Projection of internal migration

Interprovincial migration is the movement of people between Canada's provinces and territories. Internal migration parameters consist of interprovincial migration rates by origin and destination. Rates are calculated based on historical data, with the various scenarios reflecting distinct historical periods. Adjustments are made to the projected migration rates to account for the fact that migration flows change only according to the sizes and characteristics of the populations of origin, regardless of the populations of the regions of destination, and to keep the projected net migration rates close to the values observed during the selected reference periods.[1] In order to account for the magnitude of the uncertainty associated with the projection of internal migration, six hypotheses are proposed, constituting as many scenarios.

Interprovincial migration trends have changed somewhat in recent years,[2] likely largely due to the COVID-19 pandemic and some adaptations in the labour market. These changes have been observed in other countries such as Spain and Germany.[3] [4] Globally, the changes have favoured rural areas at the expense of large urban centres.

Assumption M1, which can be considered as an average hypothesis, is developed from the longest period for which data are available for all provinces and territories (after the creation of Nunavut), from 1991/1992 to 2016/2017. In the short term, however, it incorporates the recent changes described above. Thus, the migration rates of assumption M1 consist over the first ten years of a linear interpolation of the average migration rates observed between 2018/2019 and 2020/2021 towards the average rates observed between 1991/1992 and 2016/2017, rates that remain constant thereafter (after 2030/2031).[5]

Assumptions M2 to M5 reflect shorter periods, selected so that each province and territory had at least one assumption representative of a relatively favourable period (in terms of population growth) and another reflecting a relatively unfavourable period.[6] The M6 hypothesis reflects the trends observed during the very recent period 2018/2019 to 2020/2021.

Notes for Section 3.6 - Projection of internal migration

[1] Dion, P. 2017. "An alternative to fixed transition probabilities for the projection of interprovincial migration in Canada". *Population Research and Policy Review*. Volume 36, number 6, pages 871 to 901.

[2] Statistics Canada. 2021. "Canada's population estimates: Age and sex, July 1, 2021". *The Daily*. September 29. https://www150.statcan.gc.ca/n1/daily-quotidien/210929/dq210929d-eng.htm

[3] González-Leonardo, M., A. López-Gay, N. Newsham, J. Recaño, and F. Rowe. 2022. "Understanding patterns of internal migration during the COVID-19 pandemic in Spain". *Population, Space and Place*. e2578. https://doi.org/10.1002/psp.2578

[4] Stawarz, N., M. Rosenbaum-Feldbrügge, N. Sander, H. Sulak, and V. Knobloch. 2022. "The impact of the COVID-19 pandemic on internal migration in Germany: a descriptive analysis". *Population, Space and Place*. e2566. https://doi.org/10.1002/psp.2566

[5] Unlike this edition, CCPT2018's M1 assumption reflected only the migration rates observed between 1991/1992 and 2016/2017.

[6] For a more complete description of the assumptions, see: Statistics Canada. 2019. *Population Projections for Canada (2018 to 2068), Provinces and Territories (2018 to 2043): Technical Report on Methodology and Assumptions*. Catalogue number 91-620. https://www150.statcan.gc.ca/n1/pub/91-620-x/91-620-x2019001-eng.htm