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Life expectancy at birth of Indigenous populations in Canada, 2006-2011, 2011-2016 and 2016-2021

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Life expectancy at birth of Indigenous populations in Canada, 2006-2011, 2011-2016 and 2016-2021

Estimates of life expectancy at birth for the population of private households by Indigenous identity are available for Canada and selected regions for periods 2006 to 2011, 2011 to 2016 and 2016 to 2021 in [Table 17-10-0160-01](#).

1 Introduction

Life expectancy at birth can be defined as the average number of years lived by newborns who would be exposed throughout their lives to the mortality conditions observed during a particular period. It is a useful measure of population health, in part because it is not affected by the age structure of the population, and thus can be used for making comparisons between countries, regions or population groups.

Statistics Canada publishes annual estimates of life expectancy for the country and the provinces and territories. However, the methodology cannot be used to obtain disaggregated results for Indigenous populations because the data sources—the Canadian Vital Statistics - Death database (CVSD) and the Demographic Estimates Program—do not contain information on Indigenous identity.¹

The following document summarizes the data sources and methods used to compute life expectancy at birth for various Indigenous populations for a number of quinquennial periods using an alternative data source: the 2006, 2011, and 2016 Canadian Census Health and Environment Cohorts (CanCHECs).

2 Data sources

The CanCHECs are a series of population-based probability-linked datasets that combine information from the long-form census questionnaires (or the 2011 National Household Survey [NHS]) with health outcome data from administrative sources such as the CVSD,² among other databases.³ These linked datasets follow a cohort of Canadians over time for specific health outcomes such as mortality, cancer, or hospitalizations. Because the long-form census questionnaires and the NHS contain information about the self-declared identity of individuals, it is possible to use the CanCHECs to compute life expectancy of Indigenous populations.

Sampling weights are computed to make the CanCHEC cohorts more representative of the eligible population and to reduce bias attributable to missed links. With sampling weights, the CanCHEC datasets can be considered representative of the population of private households at the time of census collection. The population living in institutions such as correctional facilities, nursing homes and group homes, the population living in non-institutional collective dwellings such as rooming houses, shelters and hotels, and the population with no fixed address (i.e., unhoused) were not eligible for inclusion in the CanCHECs. Note that these exclusions apply to the populations living in institutional and collective populations at time of the census but not to cohort members who move into collective dwellings during the follow-up period.

3 Indigenous identity

Classification of Indigenous identity is determined according to responses pertaining to Indigenous identity on the long-form census questionnaires and the NHS. Individuals may have identified as more than one Indigenous group. Here, the categories First Nations (North American Indian), Métis and Inuk (Inuit) are comprised of individuals having identified as only one Indigenous group (single Indigenous responses). The following categories are used:

1. IMRs can be calculated for various population groups using the Canadian Census birth cohorts, which are linkages between Canadian Vital Statistics data on births, Canadian Vital Statistics data on deaths, and Census of Population. However, it is not possible to obtain estimates for the same observation periods as the CanCHECs. In addition, small sample sizes make it impossible to obtain disaggregated estimates for all population groups with Indigenous identity and geography of interest.
2. Statistics Canada, [Canadian Vital Statistics - Death database \(CVSD\)](https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getInstanceList&Id=1530624). Retrieved November 07, 2022.
3. Statistics Canada. 2022. [Canadian Census Health and Environment Cohorts \(CanCHEC\)](https://www23.statcan.gc.ca/en/microdata/data-centres/data/canched). Retrieved November 07, 2022.

Total –population living in private households.

A. Total Indigenous population: This category includes persons who identified as First Nations (North American Indian), Métis and/or Inuk (Inuit) and/or those who reported being Registered or Treaty Indians (that is, registered under the Indian Act of Canada), and/or those who reported having membership in a First Nation or Indian band. Individuals who self-identified with more than one Indigenous group are included in this category but excluded from the categories below.

1. **First Nations, Registered or Treaty Indians:** Includes persons who identified as First Nations (North American Indian) and not as Métis or Inuk (Inuit), and reported a Registered or Treaty Indian status.
 - a. **First Nations, Registered or Treaty Indians living on reserve:** Includes the subset of the First Nations, Registered or Treaty Indian population who were living on reserve at the time of the census.
 - b. **First Nations, Registered or Treaty Indians living off reserve:** Includes the subset of the First Nations, Registered or Treaty Indian population who were living off reserve at the time of the census.
2. **First Nations, without Registered or Treaty Indian status:** Includes persons who identified as First Nations (North American Indian) and not as Métis or Inuk (Inuit) and who did not report being a Registered or Treaty Indian.
3. **Métis:** Includes persons who identified as Métis and not as First Nations (North American Indian) or Inuk (Inuit).
4. **Inuk (Inuit):** Includes persons who identified as Inuk (Inuit) and not as First Nations (North American Indian) or Métis.

B. Non-Indigenous people: Includes persons who did not identify as First Nations (North American Indian), Métis or Inuk (Inuit), and also did not report having Registered or Treaty Indian status or membership in a First Nation or Indian band.

4 Methods

The calculation of life expectancy at birth from the CanCHECs require the following steps:

1. The (indirect) estimation of infant mortality rates;
2. The estimation of mortality rates at all other ages;
3. The calculation of life expectancy at birth and the associated variance.

Each step is described briefly below; refer to the methods section in Dion et al. (2024)^{4,5} for more detailed descriptions.

Indirect estimation of infant mortality rates

The CanCHECs are closed cohorts, meaning babies born after follow-up begins are not included. It is therefore not possible to compute mortality rates at age zero (infant mortality rates). To address this gap, Cox proportional hazards regression models are used to estimate relative mortality risks for each of the population group described in Section 2. These relative risks are then multiplied by the infant mortality rates published in Statistics Canada's life tables,⁶ to obtain corresponding rates for each population group.

Small sample sizes greatly restricted the configuration of the models. For example, it was not possible to apply the models solely to the infant population. Age groups were included as a covariate to control for the effect of age on the risk of death, as well as differences in the age composition of the population groups. Note that these

4. Dion, P., Tremblay, M.A., Gagnon, R. et al. 2024. [Life expectancy at birth and infant mortality rates of Indigenous populations in Canada from 2004 to 2016](https://doi.org/10.1007/s42650-024-00081-5). *Canadian Studies in Population*, 51(3). <https://doi.org/10.1007/s42650-024-00081-5>

5. Results found in [table 17-10-0160-01](#) may differ slightly from those presented in Dion et al. (2024). This is due to minor changes made to the methodology and updates made to the CVSD.

6. Statistics Canada. 2024. [Life tables, Canada, provinces and territories](https://www150.statcan.gc.ca/n1/en/catalogue/84-537-X). <https://www150.statcan.gc.ca/n1/en/catalogue/84-537-X>

specifications carry the implicit assumption that the same social, economic, and environmental factors influence mortality at all ages. In the case of infant mortality, however, additional factors such as quality of prenatal care, access to midwifery services, and access to birth and postnatal services could also exert an influence.⁷ Despite these limitations, the estimated infant mortality rates were comparable to estimates obtained from other data sources for comparable population groups.⁴

Estimation of mortality rates at other ages

At ages other than zero, age-specific death rates consist of the number of deaths occurring at that age divided by the estimated number of age-specific person-years lived (i.e., the sum of each individual's time spent, in years, at that specific age interval, or exposure), assuming an even distribution of deaths within a given age interval, following the standard approach proposed by Chiang (1968).⁸

Calculation of life expectancy

Life expectancy at birth is computed using abridged life tables, with the open-ended age group comprising all individuals aged 85 and over. Estimates are produced for non-overlapping periods of five years (2006-2011, 2011-2016, and 2016-2021), beginning census day of the first year and ending census day of the last. A bootstrapping method that utilizes individual CanCHEC sampling replicate weights is used to compute the standard errors of life expectancy estimates and the corresponding 95% confidence intervals. The method accounts for the impact of the complex survey design used in the census and the NHS and for the covariance between death probabilities by age.^{9,10} Estimates of life expectancy at birth by sex along with 95% confidence intervals are produced at the Canada-level and, when possible, for the following regions: the Atlantic provinces (grouped), Ontario, Quebec, the provinces of the Prairies (grouped), British Columbia, and the Territories (grouped).¹¹ Estimates are additionally produced according to residence within or outside of a Census Metropolitan Area (CMA). The availability of disaggregated estimates is subject to sample size considerations. Estimates of life expectancy for some Indigenous identity groups were found to be too unreliable for publication when further disaggregated by geography. When available, these estimates are to be used with caution due to their potentially large variability.

5 Limitations

The CanCHEC cohorts may be healthier than the general population owing to the exclusion of individuals living in institutions and non-institutional collective dwellings. The impact on estimates of life expectancy is assumed to be negligible given the relatively small proportion of Canadians included in this population. Research does, however, show that Indigenous populations tend to be overrepresented among them.^{12,13}

It is important to note that some portion of the changes in life expectancy observed over time are attributable not to changes in patterns of mortality, but to other sources of heterogeneity, including:

- Changes made to the definition of reserves¹⁴ over time and changes to the list of incompletely enumerated reserves, those for which no data are available in the census or the NHS.^{15, 16}

7. Smylie, J., Fell, D. & Ohlsson, A. 2010. A review of Aboriginal infant mortality rates in Canada: striking and persistent Aboriginal/Non-Aboriginal inequities. *Canadian Journal of Public Health*, 101(2), 143-148.

8. Chiang, C.L. 1968. The life table and its construction. *Introduction to Stochastic Processes in Biostatistics*.

9. Chiang, C.L. 1967. Variance and covariance of life table functions estimated from a sample of deaths. Public Health Service Publication, 20(1000-2), 1-8. Retrieved May 27, 2023. https://www.cdc.gov/nchs/data/series/sr_02/sr02_020acc.pdf

10. Schenker, N., Parsons, V.L., Lochner, K.A., Wheatcroft, G. & Pamuk, E.R. 2011. [Estimating standard errors for life expectancies based on complex survey data with mortality follow-up: A case study using the National Health Interview Survey Linked Mortality Files](https://doi.org/10.1002/sim.4219). *Statistics in Medicine*, 30, 1302-1311. <https://doi.org/10.1002/sim.4219>

11. Excluding Yukon for the period 2016-2021. Data for Yukon were unavailable in the CVSD for the period 2017-2022 at the time of estimation.

12. Feir, D. & Akee, R. 2018. *Estimating institutionalization and homeless for status First Nations in Canada: a method and implications*. U. o. Department of Economics, Ed. Department Discussion Papers 1801.

13. Correctional Services Canada. 2003. *Strategic Plan for Aboriginal corrections: Innovation, Learning & Adjustment, 2006-07 to 2010-11*. Correctional Services Canada.

14. Note that for estimates for 2006 to 2011, the population of First Nations, Registered or Treaty Indians living on reserve includes only individuals living on legal reserves. Individuals living in northern communities in the Northwest Territories and Yukon, which were included in the definition of the on-reserve population established by Indian and Northern Affairs Canada, are excluded. Beginning with the 2011 NHS, this definition was modified so as to exclude them.

15. There were 77 incompletely enumerated reserves in the 1996 Census, 30 in the 2001 Census, 22 in the 2006 Census, 36 in the 2011 NHS and 14 in the 2016 Census.

16. The approach taken in this study was to include all individuals who responded to maximize sample sizes, as opposed to limit the sample to a smaller subsample of individuals to reduce the number of confounding factors that may affect comparability over time.

- Availability of deaths data in the CVSD: Estimates for the period 2016 to 2021 (computed from the 2016 CanCHEC) exclude deaths that occurred in Yukon and deaths of residents of Yukon that occurred in other provinces or territories after 2016, since these deaths were not available in the CVSD.
- Changes in the composition of population groups between censuses (other than age composition). In general, multiple factors can explain differences in life expectancy between population groups, such as differences in education or income¹⁷ or place of residence.¹⁸ However, the composition of population groups can be affected by changes in the way people respond to questions on indigenous identity over time in the census, a phenomenon known as census response mobility.¹⁹ One consequence of this phenomenon is that some of the changes observed within a population group over time can be attributed solely to changes in the composition of that group.²⁰

Users are invited to consult Dion et al. (2024)⁴ for a thorough discussion on the limitations associated with the calculation of life expectancy from the CanCHECs.

17. Bushnik, T., Tjepkema, M. & Martel, L. 2020. *Socioeconomic disparities in life and health expectancy among the household population in Canada*. Statistics Canada. <https://doi.org/10.25318/82-003-x202000100001-eng>

18. Greenberg, L. & Normandin, C. 2011. *Disparities in life expectancy at birth*. Statistics Canada. Retrieved February 22, 2023. <https://www150.statcan.gc.ca/n1/pub/82-624-x/2011001/article/11427-eng.htm#ftn1>

19. O'Donnell, V. & LaPointe, R. 2019. *Response mobility and the growth of the Aboriginal identity population, 2006-2011 and 2011-2016*. Retrieved May 08, 2023 from National Household Survey: Aboriginal Peoples. <https://www150.statcan.gc.ca/n1/pub/99-011-x/99-011-x2019002-eng.htm>

20. Guimond, E. 2003. Fuzzy definitions and population explosion: Changing identities of Aboriginal groups in Canada. In D. Newhouse & E. Peters (Eds.), *Not strangers in these parts: Urban Aboriginal peoples*. Policy Research Initiative.