

## QUICK EPIDEMIOLOGICAL SUMMARY

# Ontario COVID-19 Hospital Admissions and Deaths by Age from Waves 1-7

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## Purpose

This brief report presents information on COVID-19 cases with a focus on severe outcomes, which are defined for the purpose of this analysis as COVID-19 cases who were ever admitted to hospital or died. It examines differences in these severe outcomes by age group and between the various waves.

COVID-19 waves refer to COVID-19 cases reported week using the following dates:

- Wave 1: February 26, 2020 to August 31, 2020 (length of wave 188 days)
- Wave 2: September 1, 2020 to February 28, 2021 (length of wave 181 days)
- Wave 3: March 1, 2021 to July 31, 2021 (length of wave 153 days)
- Wave 4: August 1, 2021 to December 14, 2021 (length of wave 136 days)
- Wave 5: December 15, 2021 to February 28, 2022 (length of wave 76 days)
- Wave 6: March 1, 2022 to June 18, 2022 (length of wave 110 days)
- Wave 7: June 19, 2022 to November 5, 2022 (wave is ongoing; estimates are based on available data at time of extraction)

For more detailed information on severe outcomes among COVID-19 cases, refer to the weekly [COVID-19 in Ontario](#) report. Please visit the interactive [Ontario COVID-19 Data Tool](#) to explore data for the entire COVID-19 pandemic (i.e. January 2020 onward) by public health unit (PHU), age group, sex, and time. As COVID-19 trends are also impacted by vaccine uptake and circulating variants of concern, readers may also view the [COVID-19 Vaccine Uptake in Ontario report](#) and the [SARS-CoV-2 Genomic Surveillance in Ontario](#) report for additional context.

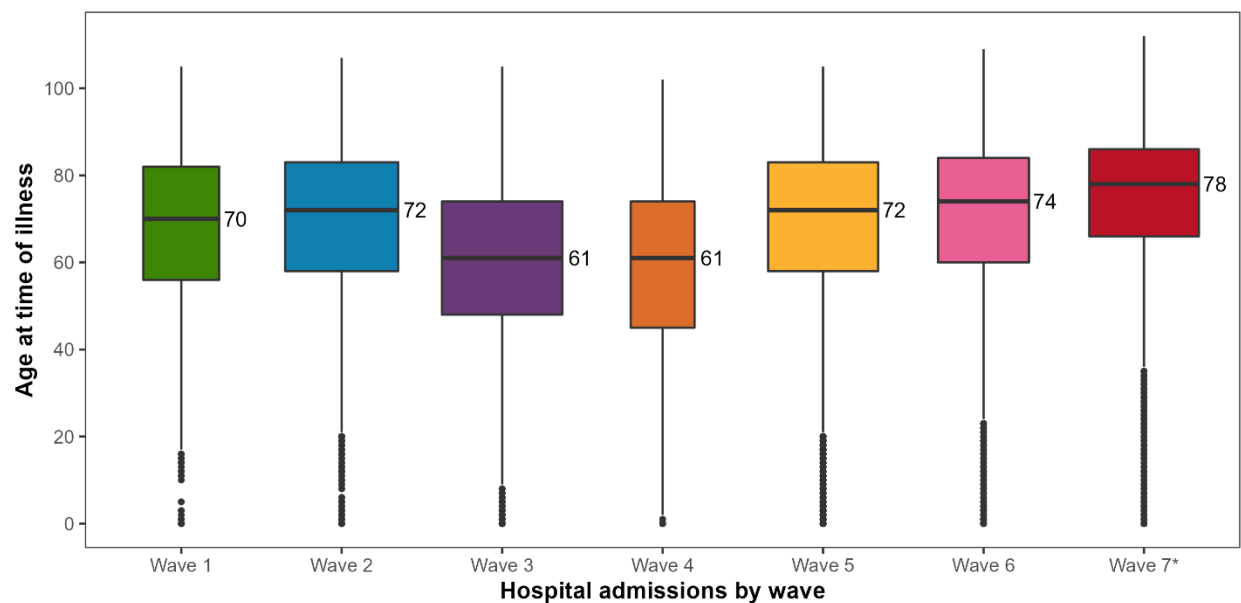
## Summary

- The lowest median ages for cases ever hospitalized (age 61 years) and for deaths (age 74 years) were seen in waves 3 and 4. In contrast, the highest median ages for cases ever hospitalized (age 78 years) and for deaths (age 86 years) were seen in wave 7 (Figure 1).
- Individuals aged 80 years and older had rates of severe outcomes notably higher than all other age groups throughout waves 1 through 7 of the pandemic. The hospitalization rate was 24 times higher and the death rate was 366 times higher among those aged 80 years and older compared to those aged 20–39 years. On the other hand, individuals 19 years old and younger were the only age group with rates of severe outcomes that were consistently lower than or equal to those of 20–39 year olds throughout the pandemic. The exception to this pattern was seen in waves 6 and 7, where individuals 19 years old and younger had hospitalization rates that were two times higher than those aged 20-39 years (Table 1).
- Estimated case fatality was highest for the 80 years and older age group across each wave of the pandemic (8.8% overall). Case fatality ratios (CFRs) — the proportion of identified cases that succumbed to their infection within the specified time period — for this age group decreased with each subsequent wave, from a ratio of 35.2% in wave 1, to a ratio of 2.9% in wave 7. The lowest CFRs were seen in the 19 and under, and 20-39 age groups (<0.1% overall) across all waves (Figure 2).

# Results

## Age Distribution of COVID-19 Hospital Admissions and Deaths by Wave

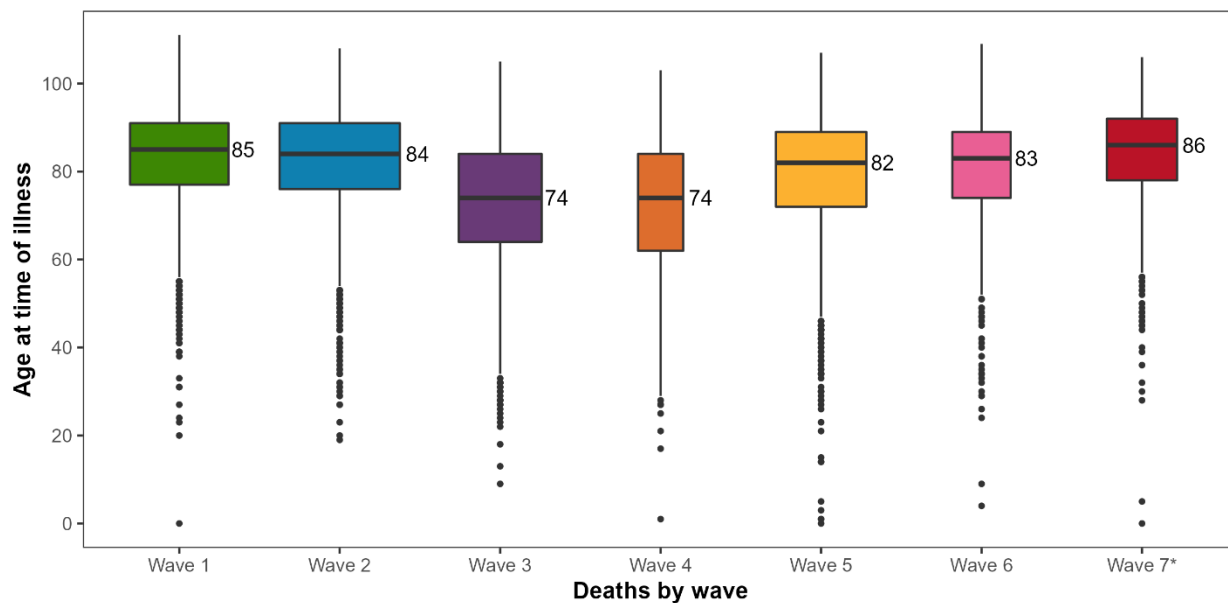
**Figure 1a. Age distribution for COVID-19 hospital admissions by wave: Ontario, February 26, 2020 to November 5, 2022**



**Notes:** The median age at time of illness for each of the waves is indicated next to the horizontal line in each box for each of the waves. The width of each box is proportionate to the number of hospitalizations that occurred in each wave. The top and bottom of the vertical lines indicate the highest and lowest ages within the 75th and 25th percentiles, respectively. Dots indicate cases with ages that were higher than the 75<sup>th</sup> percentile or lower than the 25<sup>th</sup> percentile (outliers).

\*Wave 7 is ongoing, therefore estimates are based on available data at time of extraction.

**Figure 1b. Age distribution for COVID-19 deaths by wave: Ontario, February 26, 2020 to November 5, 2022**



**Notes:** The median age at time of illness for each of the waves is indicated next to the horizontal line in each box for each of the waves. The width of each box is proportionate to the number of deaths reported in each wave. The top and bottom of the vertical lines indicate the highest and lowest ages within the 75th and 25th percentiles, respectively. Dots indicate cases with ages that were higher than the 75<sup>th</sup> percentile or lower than the 25<sup>th</sup> percentile (outliers).

\*Wave 7 is ongoing, therefore estimates are based on available data at time of extraction.

## Rate Ratios for COVID-19 Hospital Admissions and Deaths by Age Group

**Table 1. Rate ratios for COVID-19 hospital admissions and deaths by age group compared to 20–39 years old: Ontario, February 26, 2020 to November 5, 2022**

Table 1 shows the rate ratios for COVID-19 hospital admissions and deaths by age group relative to the 20–39 years-old age group throughout the pandemic and for each of waves 1–7. This age group was chosen as the reference group since it has the largest cumulative number of COVID-19 cases compared to other age groups.

| Outcomes            | <20<br>years old | 20–39<br>years old | 40–59<br>years old | 60–79<br>years old | 80+<br>years old |
|---------------------|------------------|--------------------|--------------------|--------------------|------------------|
| All waves           |                  |                    |                    |                    |                  |
| Hospital admissions | 1x               | Reference Group    | 3x                 | 7x                 | 24x              |
| Deaths              | <1x              | Reference Group    | 7x                 | 46x                | 366x             |
| Wave 1              |                  |                    |                    |                    |                  |
| Hospital admissions | <1x              | Reference Group    | 3x                 | 7x                 | 26x              |
| Deaths              | <1x              | Reference Group    | 11x                | 87x                | 987x             |
| Wave 2              |                  |                    |                    |                    |                  |
| Hospital admissions | <1x              | Reference Group    | 3x                 | 8x                 | 29x              |
| Deaths              | <1x              | Reference Group    | 9x                 | 88x                | 845x             |
| Wave 3              |                  |                    |                    |                    |                  |
| Hospital admissions | <1x              | Reference Group    | 3x                 | 4x                 | 8x               |
| Deaths              | <1x              | Reference Group    | 7x                 | 27x                | 93x              |
| Wave 4              |                  |                    |                    |                    |                  |
| Hospital admissions | <1x              | Reference Group    | 2x                 | 3x                 | 7x               |
| Deaths              | <1x              | Reference Group    | 5x                 | 15x                | 53x              |
| Wave 5              |                  |                    |                    |                    |                  |
| Hospital admissions | 1x               | Reference Group    | 2x                 | 9x                 | 30x              |
| Deaths              | 1x               | Reference Group    | 7x                 | 48x                | 343x             |

| Outcomes | <20<br>years old | 20–39<br>years old | 40–59<br>years old | 60–79<br>years old | 80+<br>years old |
|----------|------------------|--------------------|--------------------|--------------------|------------------|
|----------|------------------|--------------------|--------------------|--------------------|------------------|

Wave 6

|                     |     |                 |    |     |      |
|---------------------|-----|-----------------|----|-----|------|
| Hospital admissions | 2x  | Reference Group | 2x | 9x  | 39x  |
| Deaths              | <1x | Reference Group | 5x | 36x | 312x |

Wave 7\*

|                     |    |                 |     |      |        |
|---------------------|----|-----------------|-----|------|--------|
| Hospital admissions | 2x | Reference Group | 2x  | 13x  | 72x    |
| Deaths              | 1x | Reference Group | 11x | 130x | 1,548x |

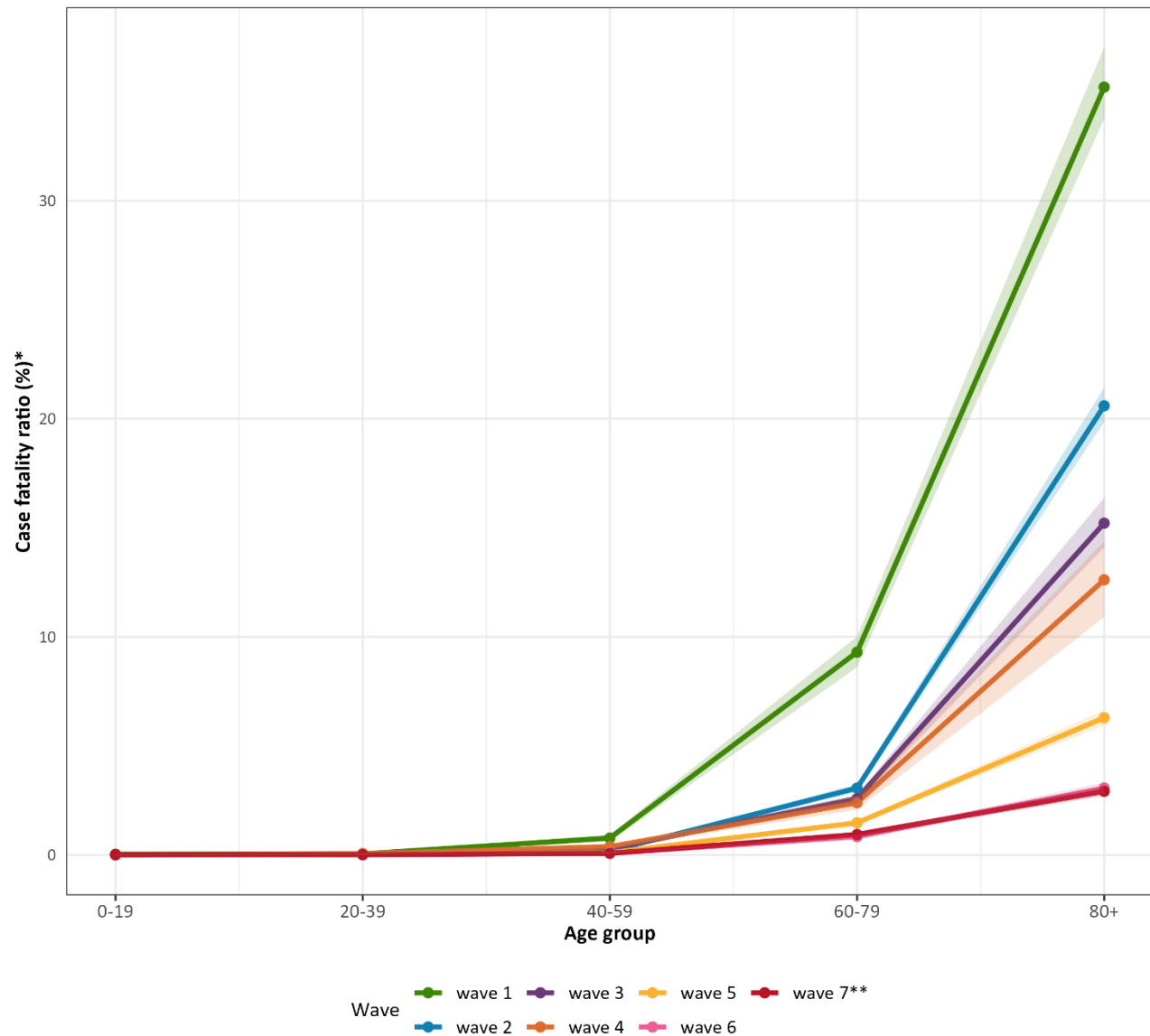
**Notes:** For each severity indicator, rate ratios were calculated by dividing the age-specific rates of hospital admissions or deaths per 100,000 population by the rates for the 20-39 age group. A rate of <1x indicates lower rates compared to the reference group and a rate of 1x indicates no difference.

Sample interpretation: In wave 1, compared to the 20-39 year age group, the rate of death was 11 times higher in the 40-59 year age group.

\*Wave 7 is ongoing, therefore estimates are based on available data at time of extraction.

## COVID-19 Case Fatality by Age Group

Figure 2. COVID-19 case fatality by age group: Ontario, February 26, 2020 to November 5, 2022



**Note:** Figure 2 shows case fatality ratios for COVID-19 cases by age group for waves 1-7. Shaded regions represent 95% confidence intervals.

\*Estimates of the case fatality ratio are presented at 30 days since symptom onset date.

\*\*Wave 7 is ongoing, therefore estimates are based on available data at time of extraction.

## Methods: Case fatality ratio (CFR)

- The case fatality ratio is the proportion of identified cases that succumbed to their infection within a specified time. For more information regarding CFR, refer to [COVID-19 Case Fatality, Case Identification, and Attack Rates in Ontario](#).
- Estimates of case fatality adjusted for censoring were calculated from Kaplan-Meier cumulative hazard estimates with days since symptom onset as the time scale. Cases were censored at their death date or after 30 days since symptom onset.
  - For cases with missing symptom onset date (N=548,929; 36.5%), date was imputed using a Generalized Additive Mixed Model based on case reported date, sex, and a random intercept for PHU.
  - Fatal cases whose death date preceded their reported symptom onset date (N=133), or fatal cases who were missing a death date (N=15), were censored at their symptom onset date.

## Data source and Caveats

- The data for this report were based on information successfully extracted from the Public Health Case and Contact Management Solution (CCM) for all PHUs by PHO as of:
  - **November 8, 2022 at 1 p.m.** for cases reported in waves 6 and 7 (March 1, 2022 onwards)
  - **November 7, 2022 at 9 a.m.** for cases reported in waves 1 to 5 (up to February 28, 2022)
- Ontario population estimate data were sourced from Statistics Canada. Population estimates 2001-2021: Table 1 annual population estimates by age and sex for July 1, 2001 to 2021, health regions, Ontario [unpublished data table]. Ottawa, ON: Government of Canada; 2021 [received April 12, 2022].
- Data on hospital admissions, and deaths are likely under-reported as these events may occur after the completion of public health follow up of cases. Cases that were admitted to hospital or died after follow-up was completed may not be captured in CCM.
- Hospital admissions includes all cases hospitalized (or that had their hospital stay extended) because of COVID-19. It includes cases that have been discharged from hospital as well as cases that are currently hospitalized. Includes Intensive Care Unit (ICU) cases but not emergency room visits.
- For surveillance purposes, a COVID-19 death is defined as a death resulting from a clinically compatible illness unless there is a clear alternative cause of death that cannot be related to COVID-19 (e.g., trauma, medically assisted death). There should be no period of complete recovery from COVID-19 between illness and reported death.
- Deaths are determined by using the Outcome and Type of Death fields in CCM. COVID-19 deaths are counted where the Outcome value is 'Fatal' and the Type of Death value is not 'DOPHS was unrelated to cause of death' or 'Under PHU Review'.

## Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Ontario COVID-19 hospital admissions and deaths by age from waves 1-7. Toronto, ON: King's Printer for Ontario; 2023.

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