

ENHANCED EPIDEMIOLOGICAL SUMMARY

Trends of COVID-19 Incidence in Ontario

The Enhanced Epidemiological Summary of the Trends of COVID-19 Incidence in Ontario will be discontinued after November 23, 2021. Related information will be found in the [Ontario COVID-19 Data Tool](#) and the [COVID-19 in Ontario: Weekly Epidemiological Summary](#). For additional inquiries related to information in the discontinued report, please contact EPIR@oahpp.ca.

This report reflects cases that have been publicly reported up to 2021-11-23. This report includes the most current information available from CCM.

Full French translation is available upon request.

Purpose

This report provides a summary on the growth of COVID-19 confirmed cases in Ontario, with a specific focus on incidence and estimates of the reproduction number, which signal whether or not transmission is under control in Ontario.

A brief description of the measures included in this report are summarized below. Additional details are outlined in the Methods section, found toward the end of this document.

Case count

The daily number of COVID-19 cases is based on the date a case was publicly reported (i.e., the date the public health unit [PHU] reported the case to Public Health Ontario [PHO] plus one day to account for the delay in public reporting). These daily numbers are used to produce an epidemic curve showing numbers of cases over time. These epidemic curves can be used to determine the current trajectory of the epidemic in each region. Projected case counts are based on an extrapolation of the current reproduction number (R_e) to estimate what case counts may be in one week from now under varying levels of transmission (i.e., constant R_e , 20% decrease in R_e over 7 days, or 20% increase in R_e over 7 days).

Reproduction number

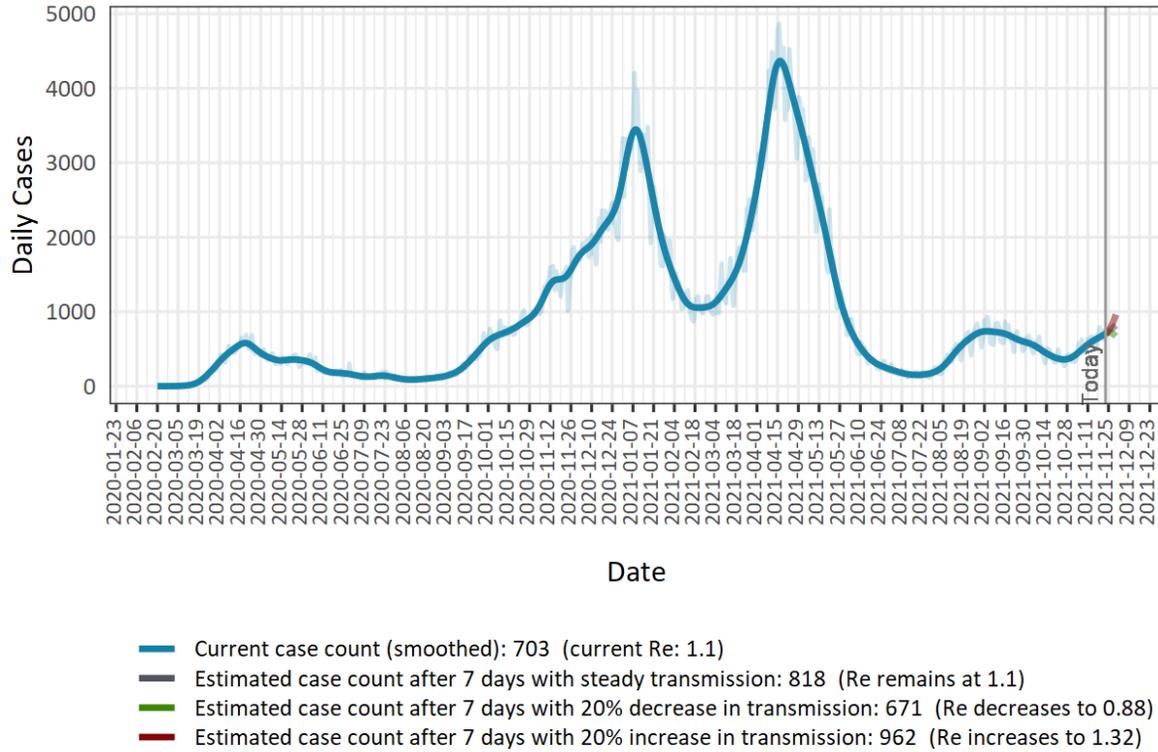
The reproduction number is the average number of secondary cases of infection generated by each person infected with COVID-19. A reproduction number greater than one means that the overall number of new cases is growing in a region, while a reproduction number less than one means the overall number of new cases is decreasing and suggests that COVID-19 is coming under control in a region.

Doubling time

The doubling time is an estimate of the number of days it will take for the number of daily COVID-19 cases to double given the current trends in incidence. It is related to the reproduction number; as the reproduction number increases, the time for cases to double decreases.

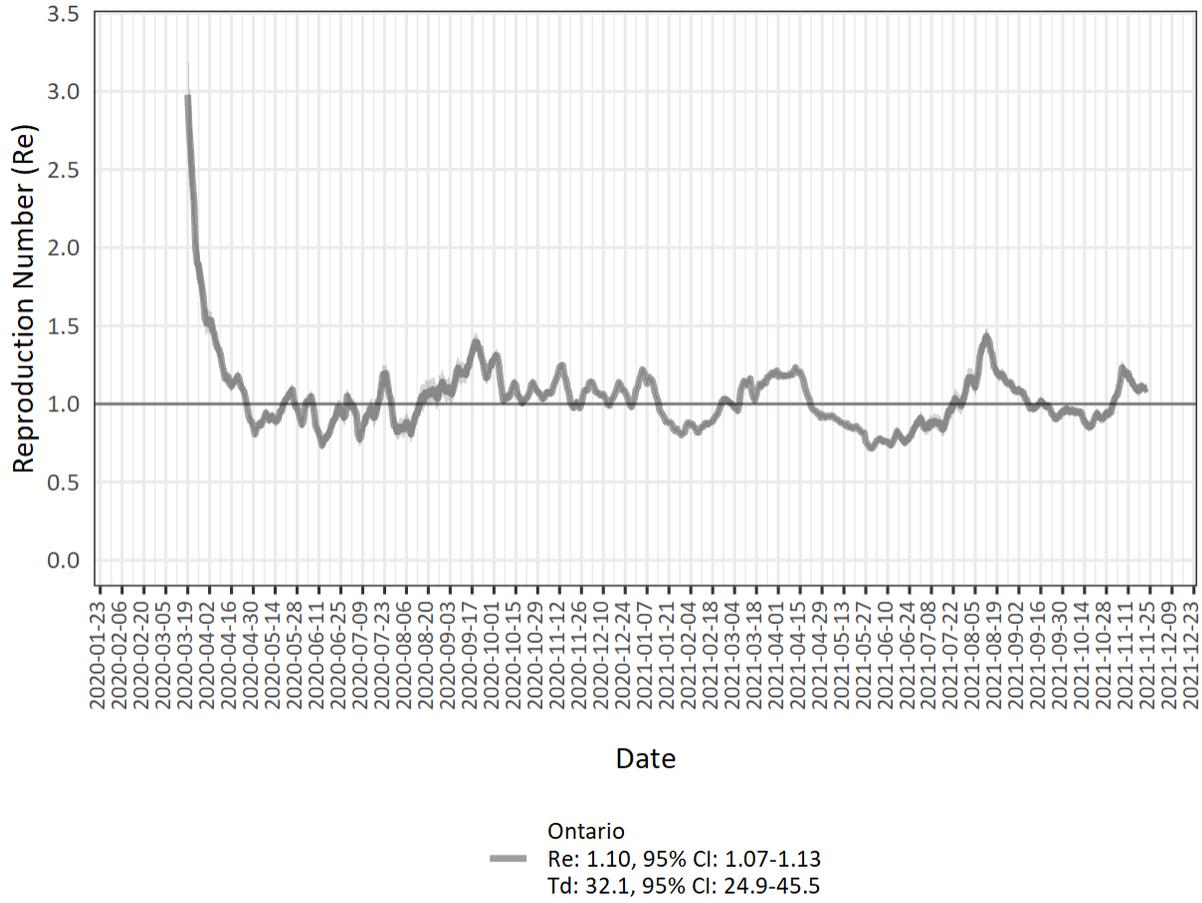
Findings

Figure 1A. Epidemic Curve: Ontario



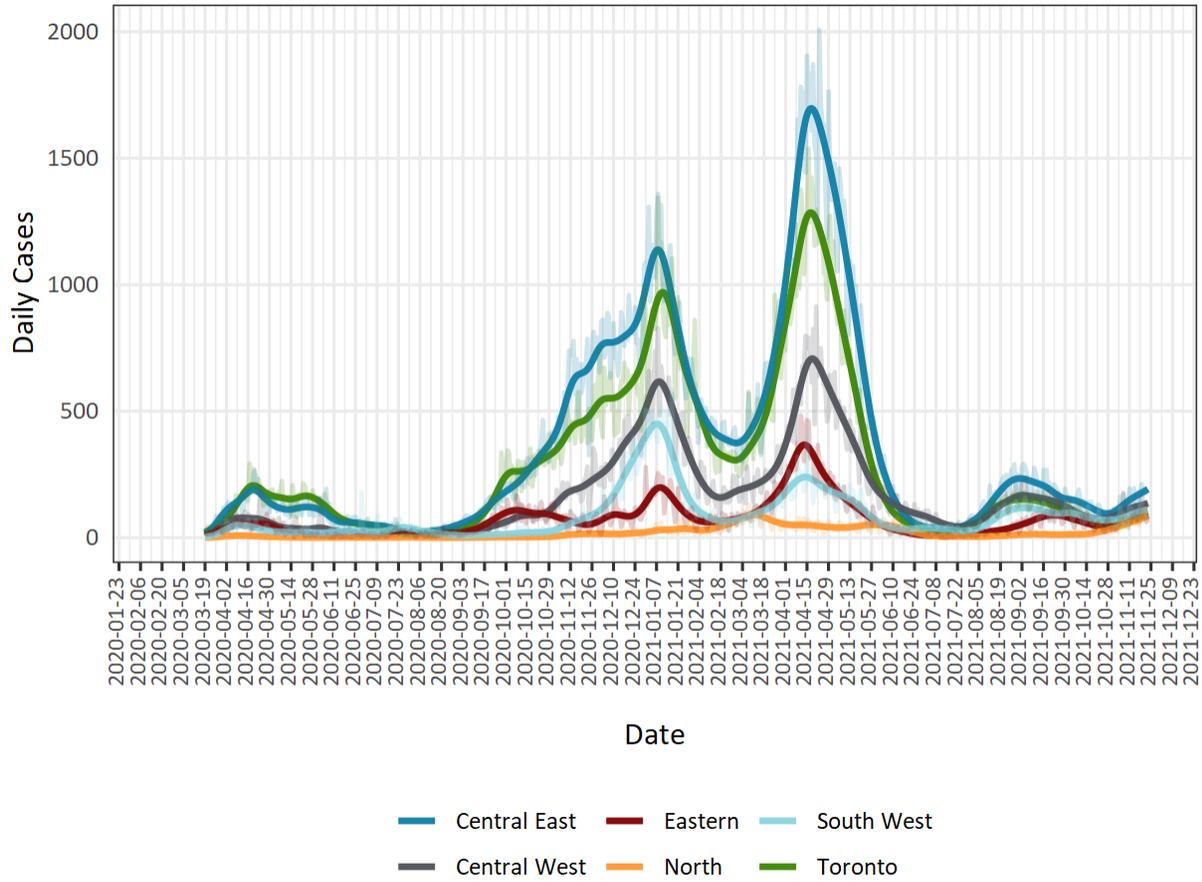
Note: The date used in this graph is the public reporting date
Data Source: CCM

Figure 1B. Reproduction Number: Ontario



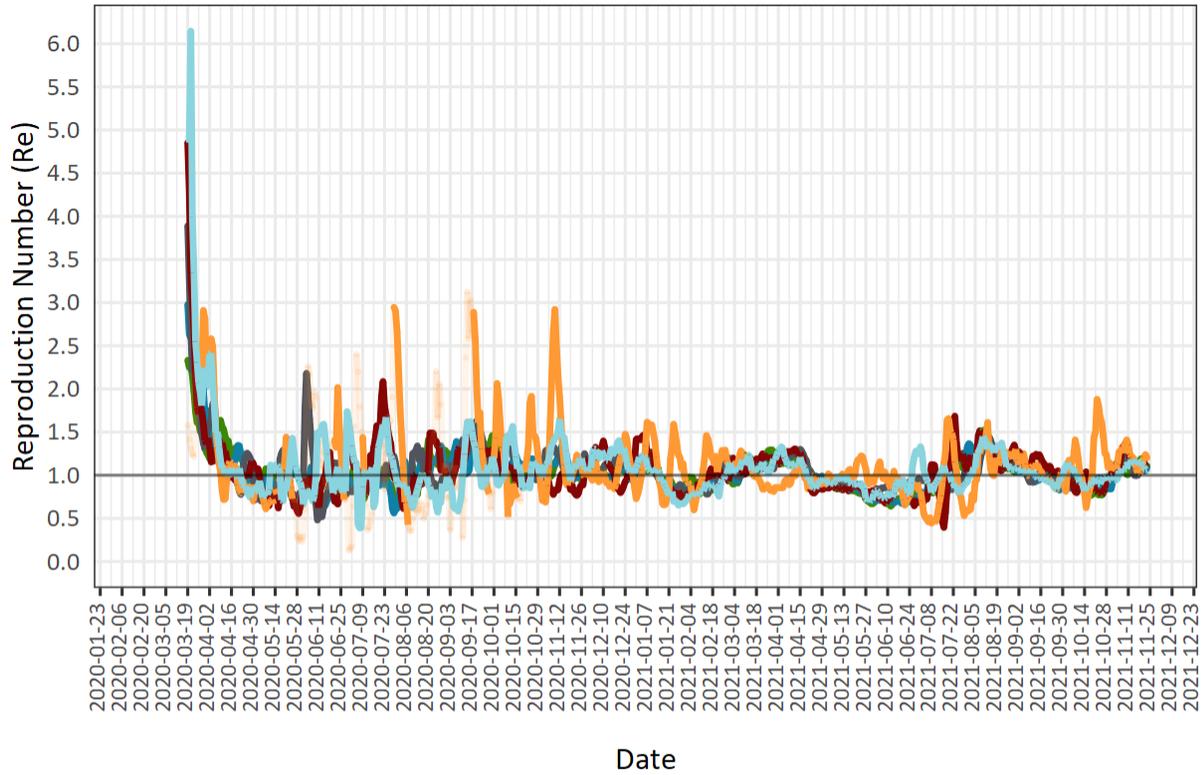
Note: The date used in this graph is the public reporting date
 Td=doubling time (days)
 Shading represents 95% confidence interval around the estimate for Re
 Data Source: CCM

Figure 2A. Epidemic Curve by Region



Note: The date used in this graph is the public reporting date
 Data Source: CCM

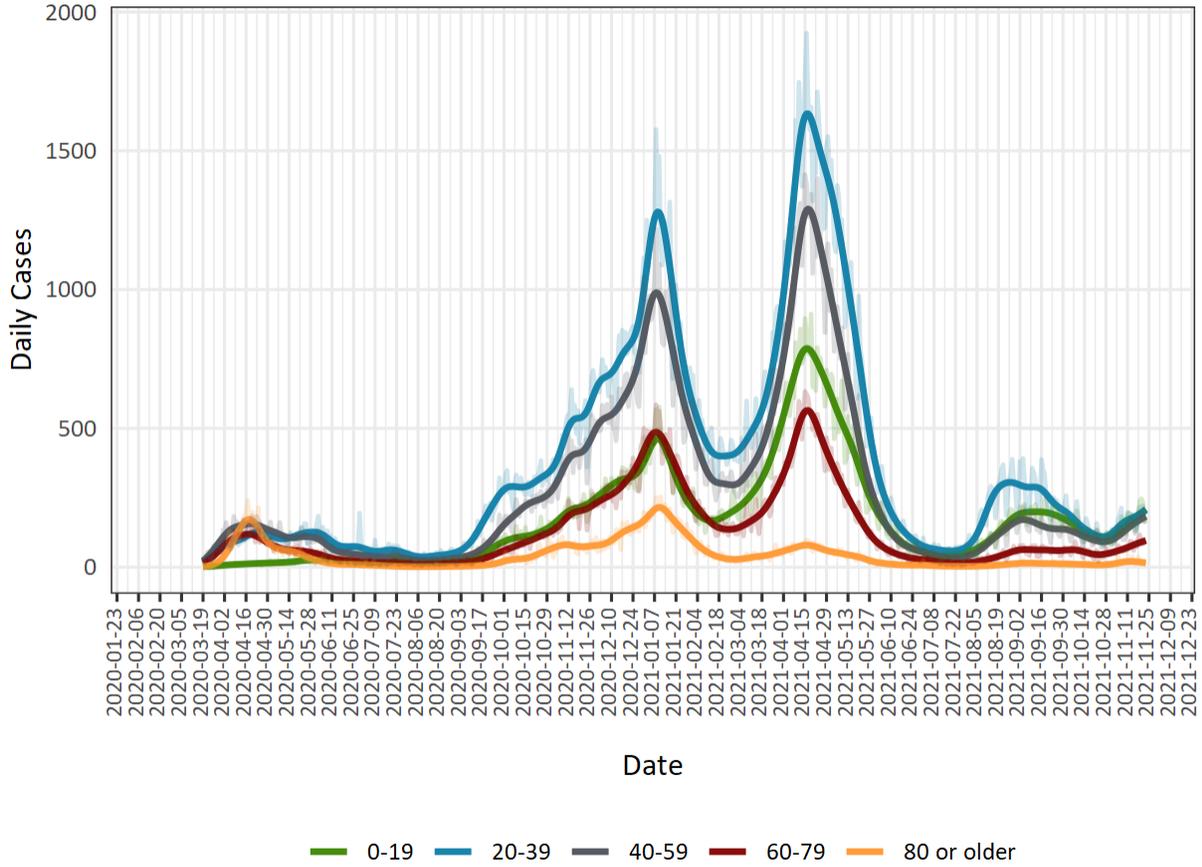
Figure 2B. Reproduction Number by Region



<p>Toronto — Re: 1.11, 95% CI: 1.02-1.20 Td: 30.9, 95% CI: 17.2->100</p>	<p>Central West — Re: 1.08, 95% CI: 1.02-1.16 Td: 38.5, 95% CI: 21.5->100</p>	<p>North — Re: 1.20, 95% CI: 1.10-1.30 Td: 17.0, 95% CI: 11.8-31.7</p>
<p>Central East — Re: 1.11, 95% CI: 1.05-1.17 Td: 30.6, 95% CI: 19.9-67.2</p>	<p>Eastern — Re: 1.08, 95% CI: 1.00-1.17 Td: 39.3, 95% CI: 20.1->100</p>	<p>South West — Re: 1.07, 95% CI: 0.99-1.14 Td: 48.0, 95% CI: 23.1->100</p>

Note: The date used in this graph is the public reporting date
 Td=doubling time (days)
 Line is transparent when there were fewer than 12 cases in the last 7 days
 Data Source: CCM

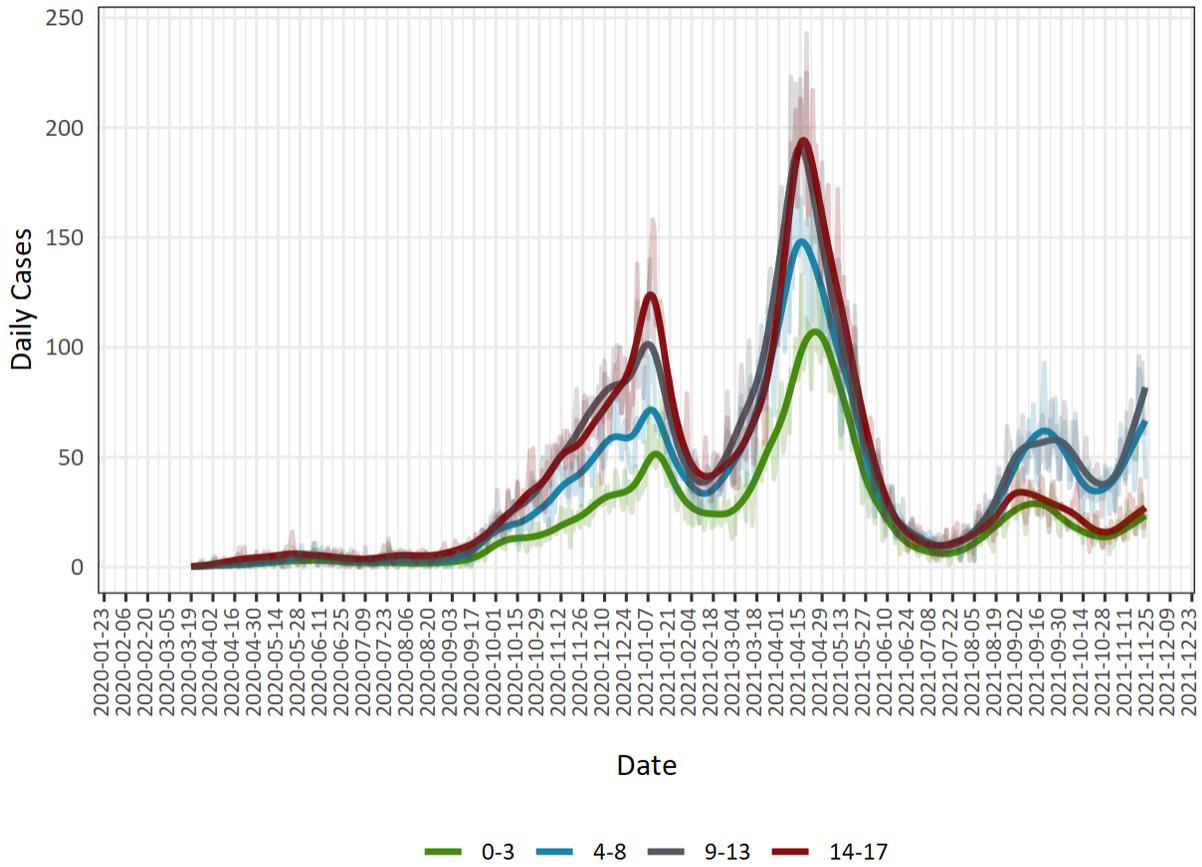
Figure 3A. Epidemic Curve by Age Group



Note: The date used in this graph is the public reporting date

Data Source: CCM

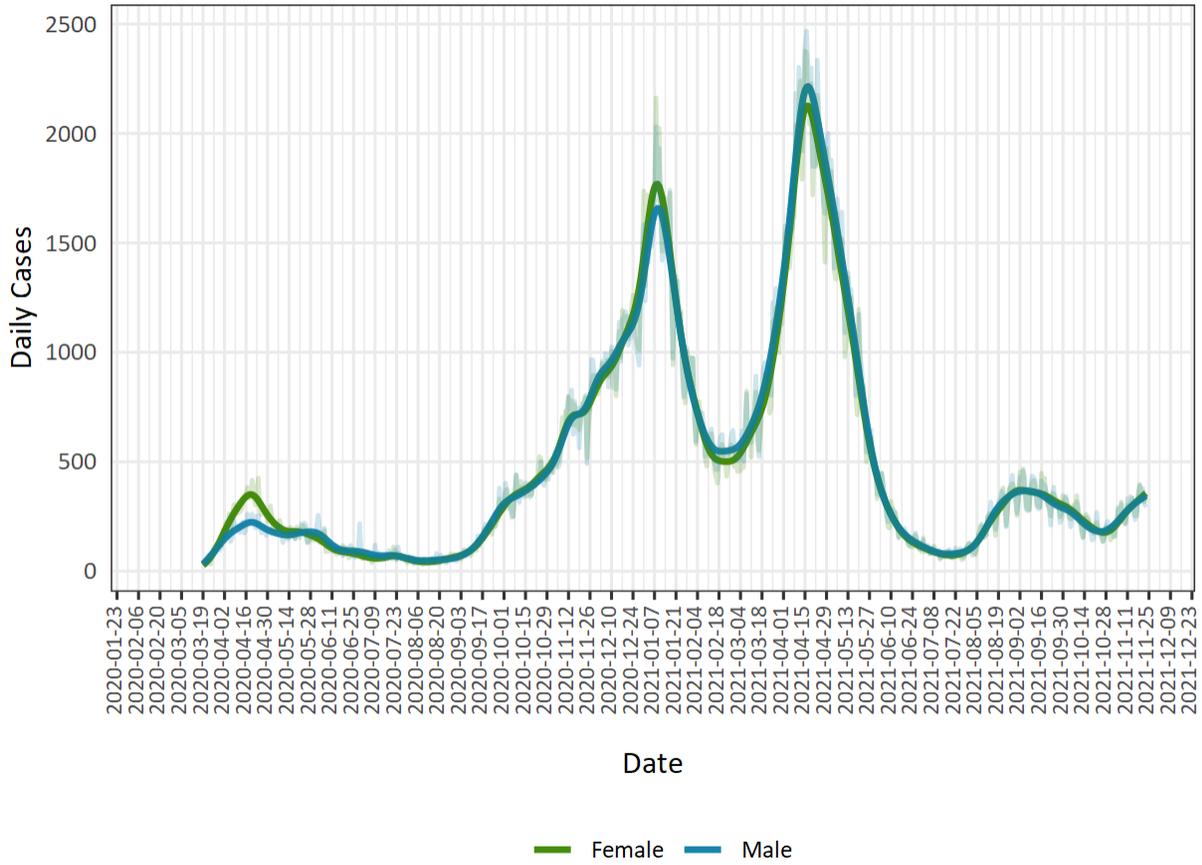
Figure 3B. Epidemic Curve in School Aged Children by Age Group



Note: The date used in this graph is the public reporting date

Data Source: CCM

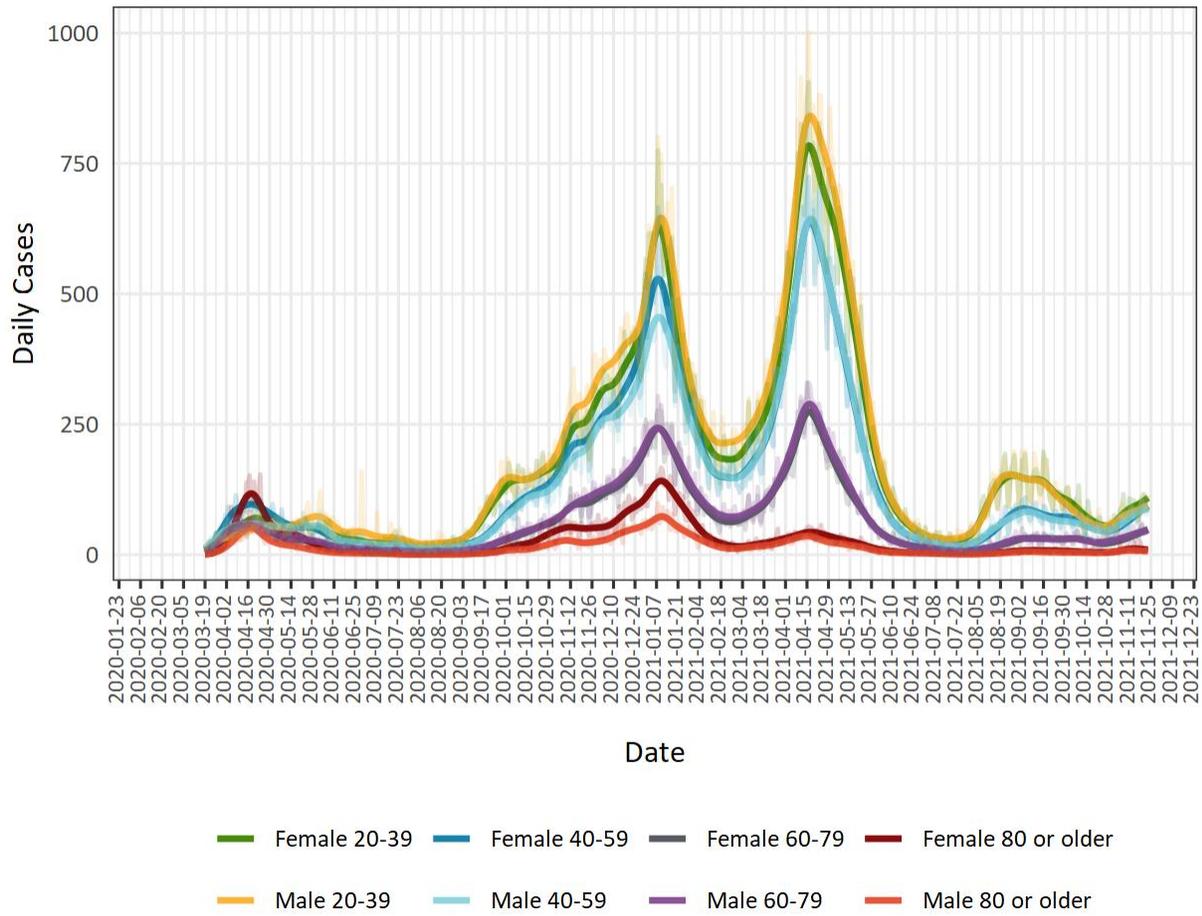
Figure 4. Epidemic Curve by Gender



Note: The date used in this graph is the public reporting date

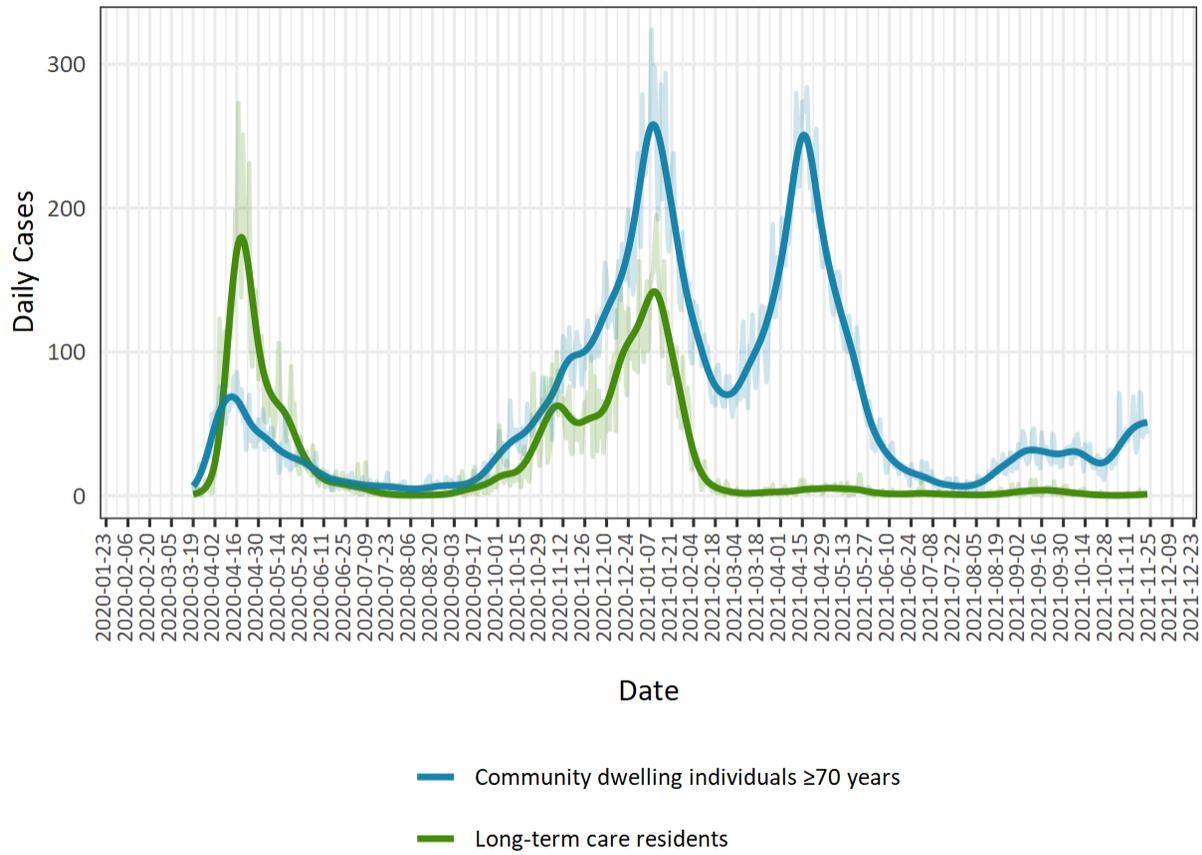
Data Source: CCM

Figure 5. Epidemic Curve by Age and Gender for Individuals Aged 20 Years or Older



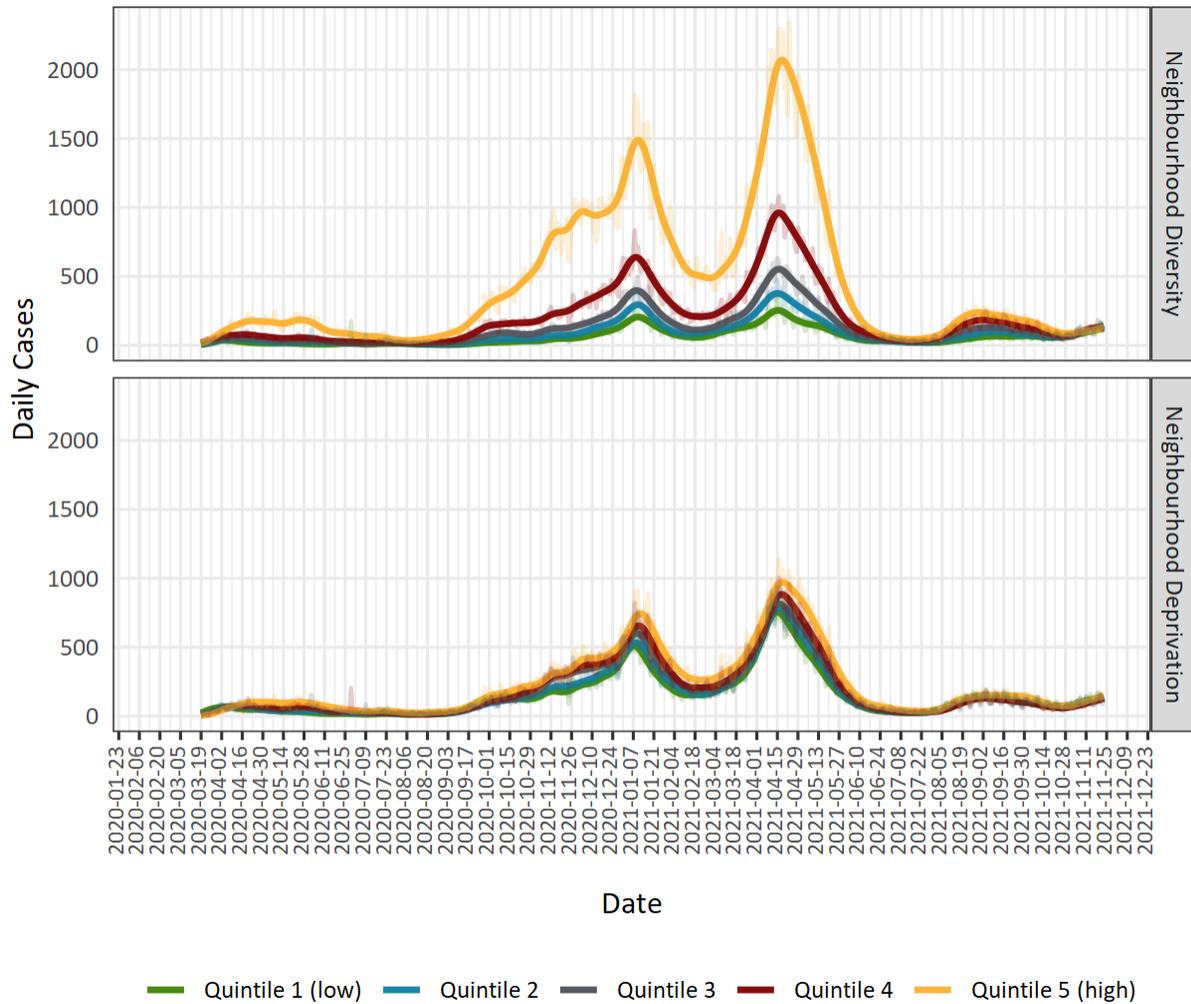
Note: The date used in this graph is the public reporting date
 Data Source: CCM

Figure 6. Epidemic Curve by Age and Residence in Long-Term Care



Note: The date used in this graph is the public reporting date
Data Source: CCM

Figure 7. Epidemic Curve by Quintile of Neighbourhood Diversity and Neighbourhood Deprivation



Note: The date used in this graph is the public reporting date
 Neighbourhood diversity and deprivation are measured using the ethnic concentration and material deprivation dimensions of the Ontario Marginalization Index. The ethnic concentration dimension is based on the proportion of non-white and non-Indigenous residents and/or the proportion of immigrants that arrived in Canada within the past five years. The material deprivation dimension uses Canadian census data on income, quality of housing, educational attainment and family structure characteristics to assess the ability of individuals and communities to access and attain basic material needs.
 Data Source: CCM, Ontario Marginalization Index

Methods

- 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 1 p.m. on the day prior to this report.
 - Statistics Canada Postal Code Conversion File (PCCF), reference date of February 2021.
 - The health equity (neighbourhood-level diversity and deprivation) analyses use data from the 2016 Ontario Marginalization Index (ON-Marg): Matheson FI; van Ingen T. 2016 Ontario marginalization index. Toronto, ON: Providence St. Joseph's and St. Michael's Healthcare; 2018. Joint publication with Public Health Ontario.
- The date variable used in the figures for the epidemic curve and the reproduction number throughout this report refers to the date that a case first appeared in the compiled data set + 1 additional day. This corresponds to the “public reporting date” of each case at the provincial level.
 - In order to account for certain instances when there were long lags between when a case's specimen was collected and when their data was entered into CCM, we replaced the public reporting date with the specimen collection date + 3 days (the mode of the distribution from specimen collection to public reporting date). This replacement was made for cases whose delay between specimen collection and case creation was between 7 and 90 days.
 - In rare circumstances when this delay was more than 90 days, we did not make the date replacement.
 - Due to de-duplication efforts, cases from Toronto Public Health first appearing on February 10 and 11 and with a case created date in January were assigned a public reporting date based on case created date + 1.
- Due to smaller case counts, we have combined the North West and North East regions into a single region in this report.
- The PHUs were categorized into regions as follows:
 - Toronto: Toronto Public Health
 - Central East: Durham Region Health Department, Haliburton, Kawartha, Pine Ridge District Health Unit, Peel Public Health, Peterborough Public Health, Simcoe Muskoka District Health Unit, and York Region Public Health
 - Central West: Brant County Health Unit, City of Hamilton Public Health Services, Haldimand-Norfolk Health Unit, Halton Region Public Health, Niagara Region Public Health, Region of Waterloo Public Health and Emergency Services, and Wellington-Dufferin-Guelph Public Health
 - Eastern: Ottawa Public Health, Eastern Ontario Health Unit, Hastings Prince Edward Public Health, Kingston, Frontenac and Lennox & Addington Public Health, Leeds, Grenville & Lanark District Health Unit, and Renfrew County and District Health Unit

- Northern: Northwestern Health Unit, Thunder Bay District Health Unit, Algoma Public Health, North Bay Parry Sound District Health Unit, Porcupine Health Unit, Public Health Sudbury & Districts, and Timiskaming Health Unit
- South West: Chatham-Kent Public Health, Grey Bruce Health Unit, Huron Perth Public Health, Lambton Public Health, Middlesex-London Health Unit, Southwestern Public Health, and Windsor-Essex County Health Unit
- Orientation of case counts by geography is based on the diagnosing health unit (DHU). DHU refers to the case's public health unit of residence at the time of illness onset and not necessarily the location of exposure.
- Epidemic curve: smoothed epidemic curves were estimated using generalized additive models of the daily number of cases.
- Projected case counts: The 7 day projected case counts are extrapolated from the current case count and the current reproduction number. Using the serial interval and the reproduction number estimate, we estimate the approximate number of daily cases in seven days from the date of this report under three different scenarios: 1) assuming current levels of transmission remain the same (i.e., R_e remains unchanged) over the next 7 days; 2) assuming that transmission decreases by 20% over the seven day period (i.e., R_e is 20% lower in 7 days compared to today); and 3) assuming that transmission increases by 20% over the seven day period (i.e., R_e is 20% higher in 7 days compared to today).
- Reproduction number: the reproduction number was measured using the EpiEstim package in R.¹ The procedure uses daily reported case counts and a 7-day rolling window for estimation. The mean serial interval was set at 4.5 days with a standard deviation of 2.5 days, as adapted from published estimates.^{2,3} EpiEstim uses a Markov Chain Monte Carlo sampling procedure, and the median represents the middle of the distribution of most probable values of the reproduction number. Note that the reproduction number of a region is less reliable when there are fewer than 12 cases in that region in the last 7 days.
- Doubling time: the doubling time was estimated using the serial interval and the reproduction number for a given day. The following formula was used to estimate doubling time: $\text{serial interval} / \log_2(\text{reproduction number})$. When the estimated reproduction number was <1.0317 (corresponding to a doubling time of more than 100 days), the doubling time was simply reported as ">100 days".
- "Long-term care home residents" includes cases that reported "Yes" to the risk factor "Resident of a long-term care home"; or "Yes" to the risk factor "Resident of nursing home or other chronic care facility" and reported to be part of an outbreak assigned as a long-term care home (via the Outbreak number or case comments field); or were reported to be part of an outbreak assigned as a long-term care home (via the outbreak number or case comments field) with an age over 70 years and did not report "No" to the risk factors "Resident of long-term care home" or "Resident of nursing home or other chronic care facility". "Long-term care home residents" excludes cases that reported "Yes" to any of the health care worker occupational risk factors.

- Neighbourhood diversity is defined using the ethnic concentration dimension of ON-Marg, which measures populations who may experience marginalization related to racism and discrimination. It is based on the proportion of non-white and non-Indigenous residents (visible minority) and/or the proportion of immigrants that arrived in Canada within the past five years. ‘Visible minority’ is a term used by Statistics Canada that, although is considered to be outdated, is used here to be consistent with the Canadian census.
- Neighbourhood deprivation is defined using the material deprivation dimension of ON-Marg, which is closely connected to poverty. It refers to the inability of individuals and communities to access and attain basic material needs. The indicators included in this dimension measure income, quality of housing, educational attainment and family structure characteristics.
- “Neighbourhoods” are considered to be Statistic Canada dissemination areas (DA). The Single Link Indicator Postal Code Conversion File (PCCF) was used to match individuals to a DA based on their postal code, which were subsequently assigned to a quintile of marginalization that contained 20% of Ontario neighbourhoods. The quintiles for the ethnic concentration and the material deprivation dimensions are ordered from quintiles 1 to 5, with quintile 1 having the lowest level of marginalization (i.e., least diverse or least deprived) and quintile 5 having the highest level of marginalization (i.e., most diverse or most deprived).
- The following were not included in analyses that summarize the impact of COVID-19 among Ontarians who may experience marginalization:
 - People who have tested positive for COVID-19 that reside in institutional and congregate settings are not included in the census data from which the marginalization indicators (ethnic concentration and material deprivation) are derived. Although these cases represent a large number of cases overall and deaths, their exclusion ensures appropriate comparisons since institutional and congregate setting residents are excluded from ON-Marg.
 - People who have tested positive for COVID-19 that reside in census dissemination areas where data has been suppressed, and cases that have missing or invalid postal codes could not be assigned to a quintile of marginalization.
 - Due to data suppression for some census indicators on Indian Reserves in Ontario, residents of Indian Reserves could not be included in ON-Marg and therefore people who have tested positive for COVID-19 and are living on Indian Reserves could not be assigned to a quintile of marginalization. While Indigenous individuals living off reserves are included in this analysis, Indigeneity data is not currently collected or captured in dimensions of ON-Marg.

Limitations

- This report includes confirmed cases of COVID-19 as per the Ontario Ministry of Health [case definition](#).⁴ However, this report excludes persons with a positive detection of serum/plasma immunoglobulin G (IgG) antibodies to SARS-CoV-2, which was added to the confirmed case definition on August 6, 2020. Case detection is strongly influenced by the provincial testing

strategy, which may also influence the time elapsed between various steps in the testing and notification process.

- Cases of confirmed reinfection, i.e. where genome sequencing indicates the two episodes are caused by different viral lineages, added to the confirmed case definition on November 20, 2020, are counted as unique investigations.
- CCM is a dynamic disease reporting systems, which allow ongoing updates to data previously entered. As a result, data extracted represent a snapshot at the time of extraction and may differ from previous or subsequent reports.
- The data only represent cases reported to public health units and recorded in CCM. As a result, all counts will be subject to varying degrees of underreporting due to a variety of factors, such as disease awareness and medical care seeking behaviours, which may depend on severity of illness, clinical practice, changes in laboratory testing, and reporting behaviours.
- The public reporting date lags the infection date; as such, public reporting dates likely represent infections that occurred approximately 10 days earlier.
- For reproduction number analyses, all cases since initial importation were presumed to be locally transmitted. Further, the estimates of the reproduction number are influenced by the choice of serial interval. As such, the reported estimates in the analysis are subject to change as additional data on the estimated serial interval are published.
- The epidemic curves in this report will not align with the curves provided in other reports due to the date chosen. In monitoring trends over time, the public reporting date was specifically chosen in order to identify early signals of increasing cases, which is challenging when using episode date or reported date due to lags in data entry and therefore the need for caution when reviewing case data for more recent days. As such, numbers from the epidemic curve should not be compared between this regional report and the daily/weekly epidemiologic summary.
- ON-Marg is a data tool that combines a wide range of demographic indicators into multiple distinct dimensions of marginalization. It is an area-based index which assigns a measure of marginalization based on neighbourhood versus individual characteristics. As such, the broader demographic trends of an area may not reflect all residents of a neighbourhood owing to the inherent heterogeneity of demographic characteristics which can vary substantially especially across large rural geographies. For more information, please visit [PHO's ON-Marg website](#).
- ON-Marg quintiles are derived by dividing Ontario neighbourhoods into groups of equal number of neighbourhoods. Neighbourhoods do not have uniform population sizes, and therefore ON-Marg quintiles do not represent equal fractions of the Ontario population. Caution should be taken when comparing counts across quintiles, since the underlying population sizes are different.

Notes

Note that data from the CORES system were not available for cases from Toronto Public Health with a publicly reported date of 2020-08-13, and data from iPHIS were not available for cases from Algoma Public Health, Brant County Health Unit, Chatham-Kent Public Health, City of Hamilton Public Health Services, Niagara Region Public Health, Peterborough Public Health, Simcoe Muskoka District Health Unit, Southwestern Public Health, Public Health Sudbury & Districts, Timiskaming Health Unit, and Windsor-Essex County Health Unit with a publicly reported date of 2020-08-19; as such, estimates and figures reflecting or incorporating these health units will be impacted for these dates. Additionally, due to a discrepancy in data extract times, cases in Ontario with a publicly reported date of 2020-11-22 were over-estimated, leading to an under-estimate for those with a publicly reported date of 2020-11-23. Due to a data processing error, cases with a publicly reported date of 2020-12-03 were over-estimated for Middlesex-London Health Unit and cases with a publicly reported date of 2020-12-04 were over-estimated for Ottawa Public Health. As such, metrics based on the public reporting date of 2020-12-03 and 2020-12-04 should be interpreted with caution as they may have been over-estimated. Due to a discrepancy in data extract times, cases in Ontario with a publicly reported date of 2020-12-15 were over-estimated. Due to a data processing error, cases with a publicly reported date of 2021-01-08 were over-estimated for Toronto Public Health. Due to a data processing error, cases with a publicly reported date of 2021-01-19 were under-estimated for Toronto Public Health. Due to Toronto Public Health's data migration to CCM and subsequent identification of duplicate cases and data corrections, cases with a date of 2021-02-02 should be interpreted with caution. Due to issues with CCM, cases with a publicly reported date of 2021-03-25 were over-estimated (mainly affecting Toronto Public Health) and should be interpreted with caution. Due to a catch-up in processing laboratory data into CCM, counts with a public reporting date of 2021-04-28 for some health units in the Central West region were over-estimated and should be interpreted with caution. Due to a technical issue with the laboratory data feed, cases with a publicly reported date of 2021-05-06 may be underreported for the Central East, Central West and Toronto regions. Due to an error affecting cases publicly reported by Toronto Public Health, in December 2020 and earlier, cases were previously under-estimated. This under-estimation may have affected the total number of confirmed cases reported as of 2021-06-21. It was previously reported that an under-estimation regarding the case counts reported by Toronto Public Health may have affected the total number of confirmed cases reported as of 2021-06-21. Toronto Public Health has conducted a data review and data re-mediation for some cases incorrectly reported as not meeting the case definition from December earlier. As of June 29, 2021, about 90 cases from 2020 were included in Toronto Public Health's case count. As of July 5, 2021, 80 cases from 2020 were included in Toronto Public Health's case count. Male and Female information presented in this report are sourced from the Sex field in CCM and are intended to represent sex assigned at birth. On October 14, 2021 changes were made in CCM to enable reporting on the Sex field where these data are supplemented by archived Male/Female information previously entered in the Gender field.

References

1. Cori A, Ferguson NM, Fraser C, Cauchemez S. A new framework and software to estimate time-varying reproduction numbers during epidemics. *Am J Epidemiol*. 2013;178(9):1505–12. Available from: <https://doi.org/10.1093/aje/kwt133>
2. Nishiura H, Linton NM, Akhmetzhanov AR. Serial interval of novel coronavirus (COVID-19) infections. *Int J Infect Dis*. 2020;93:284–6. Available from: <https://doi.org/10.1016/j.ijid.2020.02.060>
3. Du Z, Xu X, Wu Y, Wang L, Cowling BJ, Ancel Meyers L. Serial interval of COVID-19 among publicly reported confirmed cases. *Emerg Infect Dis*. 2020;26(6):1341-3. Available from: <https://doi.org/10.3201/eid2606.200357>
4. Ontario. Ministry of Health; Ministry of Long-Term Care. COVID-19: guidance for the health sector: case definition [Internet]. Toronto, ON: Queen’s Printer for Ontario; 2020 [cited 2020 Sep 28]. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/coronavirus/2019_guidance.aspx#case

Citation

Ontario Agency for Health Protection and Promotion (Public Health Ontario). Trends of COVID-19 incidence in Ontario. Toronto, ON: Queen's Printer for Ontario; 2021.

Disclaimer

This document was developed by Public Health Ontario (PHO). PHO provides scientific and technical advice to Ontario's government, public health organizations and health care providers. PHO's work is guided by the current best available evidence at the time of publication.

The application and use of this document is the responsibility of the user. PHO assumes no liability resulting from any such application or use.

This document may be reproduced without permission for non-commercial purposes only and provided that appropriate credit is given to PHO. No changes and/or modifications may be made to this document without express written permission from PHO.

For Further Information

For more information, email epir@oahpp.ca.

Public Health Ontario

Public Health Ontario is an agency of the Government of Ontario dedicated to protecting and promoting the health of all Ontarians and reducing inequities in health. Public Health Ontario links public health practitioners, front-line health workers and researchers to the best scientific intelligence and knowledge from around the world.

For more information about PHO, visit publichealthontario.ca.

