

TECHNICAL NOTES

COVID-19 Wastewater Surveillance in Ontario

Updated: April 2023

The [COVID-19 Wastewater Surveillance in Ontario](#) report presents COVID-19 wastewater signals in Ontario and sub-regions. Analyses are conducted by Public Health Ontario (PHO) based on the original work of the Ontario COVID-19 Science Advisory Table entitled, *Wastewater Signals in Ontario*¹, using data collected as part of the Ministry of Environment, Conservation, and Parks (MECP) Wastewater Surveillance Initiative (WSI).

Glossary

Ontario Sub-regions

These refer to the following geographical groupings of public health units:

- **North West:** Northwestern Health Unit and Thunder Bay District Health Unit.
- **North East:** Algoma Public Health; North Bay Parry Sound District Health Unit; Porcupine Health Unit; Public Health Sudbury & Districts; and Timiskaming Health Unit.
- **Eastern:** Eastern Ontario Health Unit; Hastings Prince Edward Public Health; Kingston, Frontenac and Lennox & Addington Public Health; Leeds, Grenville & Lanark District Public Health; Ottawa Public Health; and Renfrew County and District Health Unit.
- **Central East, excluding GTA:** Haliburton Kawartha and Pine Ridge District Health Unit; Peterborough Public Health; and Simcoe Muskoka District Health Unit.
- **Greater Toronto Area (GTA):** Durham Region Health Department; Halton Region Public Health; Peel Public Health; Toronto Public Health; and York Region Public Health
- **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.
- **Central West, excluding GTA:** Brant County Health Unit; Haldimand-Norfolk Health Unit; City of Hamilton Public Health Services; Niagara Region Public Health, Region of Waterloo Public Health and Emergency Services; and Wellington-Dufferin-Guelph Public Health.

Sampling Date

This refers to the date that the wastewater sample was collected.

Standardized Concentration of SARS-CoV-2 Gene Copies

This calculated measure refers to the estimated wastewater signal for SARS-CoV-2 using analytic methods developed by the former Ontario COVID-19 Science Advisory Table (described below).¹

Data Source

Wastewater gene concentration data are extracted from the MECP WSI data hub's *Ontario – Extended Aggregated WSI Dataset* [unpublished data table]. Data are extracted weekly on Wednesdays by Public Health Ontario.

Methods

The COVID-19 Wastewater Surveillance in Ontario report is based on the original work of the Ontario COVID-19 Science Advisory Table entitled, *Wastewater Signals in Ontario*. This method provides a province-wide COVID-19 wastewater signal for Ontario by taking a weighted mean of the standardized, biomarker-normalized concentrations of SARS-CoV-2 gene copies sampled across 59 wastewater treatment plants, pumping stations and sewersheds located in all 34 public health units.

Given differences in testing, sampling, and watershed characteristics across the province, each time-series of biomarker-normalized gene concentrations (N1 and N2) is standardized at each sampling location, by dividing by the site- and gene-specific standard deviation, and then log transformed. Next, the averaged daily standardized gene concentration (i.e., the average of the standardized N1 and N2 signals) for each sampling location is smoothed using restricted cubic splines, with knots located every 14 days.

The above estimates are subsequently aggregated to provide regional and provincial trends. To create regional and provincial signals, a fixed-effects meta-analysis approach is applied using an inverse-variance weighted mean of the log transformed smoothed estimates for each wastewater treatment plant, pumping station, and sewershed. The estimates are weighted by the estimated 2021 corresponding sewershed populations (i.e. the number of people served by a sampling site/treatment plant) provided in the WSI Dataset and standard errors estimated during the smoothing process.

Analyses are conducted using R (version 4.1.3).

Data Notes and Caveats

- Samples are typically taken 3-5 times per week at each location. There is an estimated lag of 5 to 7 days between the detection of SARS-CoV-2 gene copies in sampled wastewater and the diagnosis and reporting of COVID-19 cases. The wastewater signal on January 21, for example, is reflected in reported COVID-19 cases around January 26 to 28.

- Ontario’s wastewater surveillance is coordinated and hosted by the MECP. Laboratory analyses are done by Carleton University, University of Guelph, Health Sciences North Research Institute, McMaster University, National Microbiology Laboratory, Ontario Tech University, University of Ottawa, Queen’s University, Toronto Metropolitan University, University of Toronto, Trent University, University of Waterloo, University of Western Ontario and University of Windsor.
- Previously presented wastewater signals are subject to change for the following reasons:
 - Incorporation of newly received results that were not available in previous weeks due to occasional shipping and laboratory processing delays. This may result in signal changes compared to previous weeks.
 - Revisions to previously submitted data. Examples include updates to analytical methods made at testing laboratories and re-processing of previously tested samples.
 - Standard deviations which are used to standardize the entire time series are recalculated weekly as data are added or updated, resulting in changes to the historical signal.
- The presented graphs display estimates of wastewater signals using the statistical approaches described above. As the graphs include recent periods of time for which complete data are not yet available, more recent estimates are subject to change with receipt of additional data. The dotted line and grey background on the graphs represent days or weeks where the wastewater signals are most sensitive to changes such as, but not limited to, new or updated data submissions and/or the analytical weighting method that is used. For example, the standardized values are plotted when at least 50% of data are available for any of the genes for a given date. As such, the dotted portion of the curve within the grey box is subject to change as more data become available.
- The number of wastewater treatment plants, pumping stations and sewersheds providing data from each of the seven regions are:
 - North West: 3
 - North East: 7
 - Eastern: 10
 - Central East, excluding GTA: 6
 - Greater Toronto Area (GTA): 10
 - South West: 13
 - Central West, excluding GTA: 10

References

1. Jüni P, da Costa BR, Maltsev A, Katz GM, Perkhun A, Yan S, et al. Briefs of the Ontario COVID-19 Science Advisory Table: Ontario dashboard: tracking Omicron [Internet]. Toronto, ON: Ontario COVID-19 Science Advisory Table; 2021 [cited 2022 Sep 4]. Available from: <https://doi.org/10.47326/ocsat.dashboard.2021.1.0>

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