Wastewater Modelling Report: Forecasting the State of the Pandemic using Wastewater Data

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Public Health Agency of Canada has developed a mathematical model for conducting wastewater based forecasting that describes infections of COVID-19 in the community and also considers how infected people shed the COVID-19 virus into the sewer systems and how that shed virus signal is detected and reported. The clinical case and wastewater surveillance data are used to generate forecasts and help understand what is happening in the community.

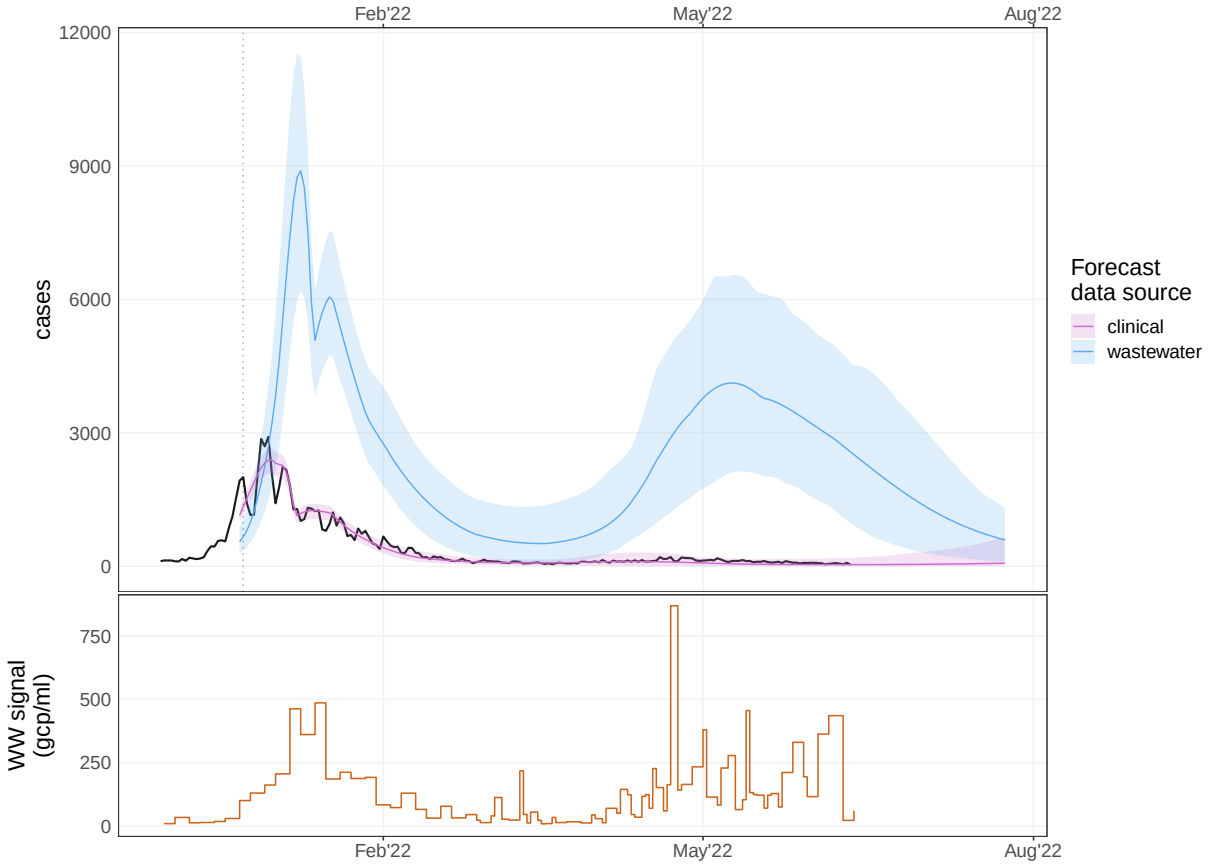
The next figures show clinical case and wastewater surveillance data for each city during the Omicron wave. In each figure, the top panel shows the traditional reported human clinical case data (solid black line), model forecasts using only clinical data (pink shaded area), and model forecasts using only wastewater data (blue shaded area). The bottom panel shows the SARS-CoV-2 signal in wastewater (brown line).

The model uses clinical surveillance and wastewater data with the following last observation dates for each site:

City	clinical	wastewater
Halifax	2022-06-17	2022-06-08
Edmonton	2022-06-13	2022-06-12
Montreal	2022-06-14	2022-06-12
Toronto	2022-06-14	2022-06-12
Vancouver	2022-06-11	2022-06-12
Saskatoon	2022-02-06	2022-06-15
Winnipeg	2022-06-11	2022-06-16

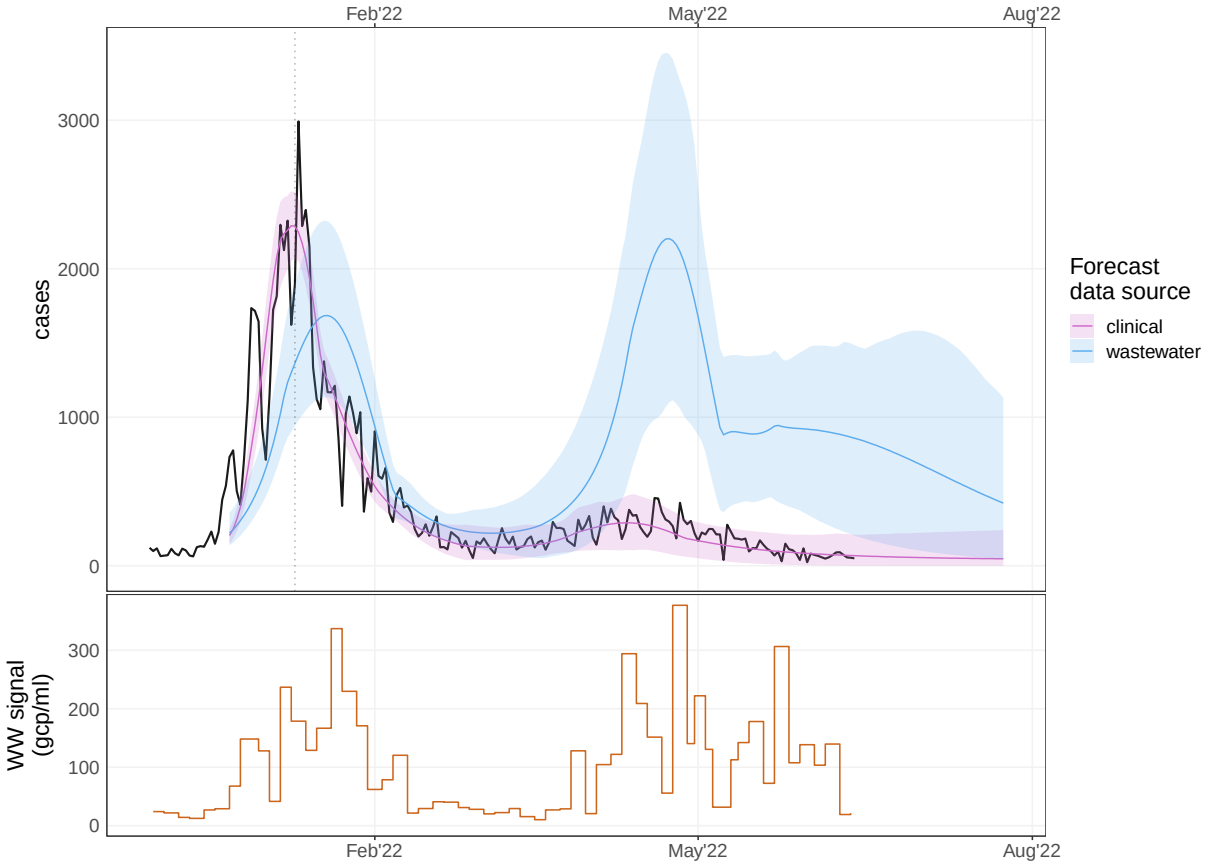
Vancouver

Based on wastewater data (bottom panel, brown curve), the model estimates the recent infection wave may have peaked (top panel, blue curve). However, the reported clinical data (top panel, black curve) did not identify a recent wave of infection as predicted by wastewater projections. This suggests an under-reporting of clinical cases during the April-to-June wave. Wastewater-based projections indicate a decline in the number of cases (top panel, blue curve), however using only the clinical data source, the model anticipates a low and stable number of infections during the summer (top panel, pink curve).



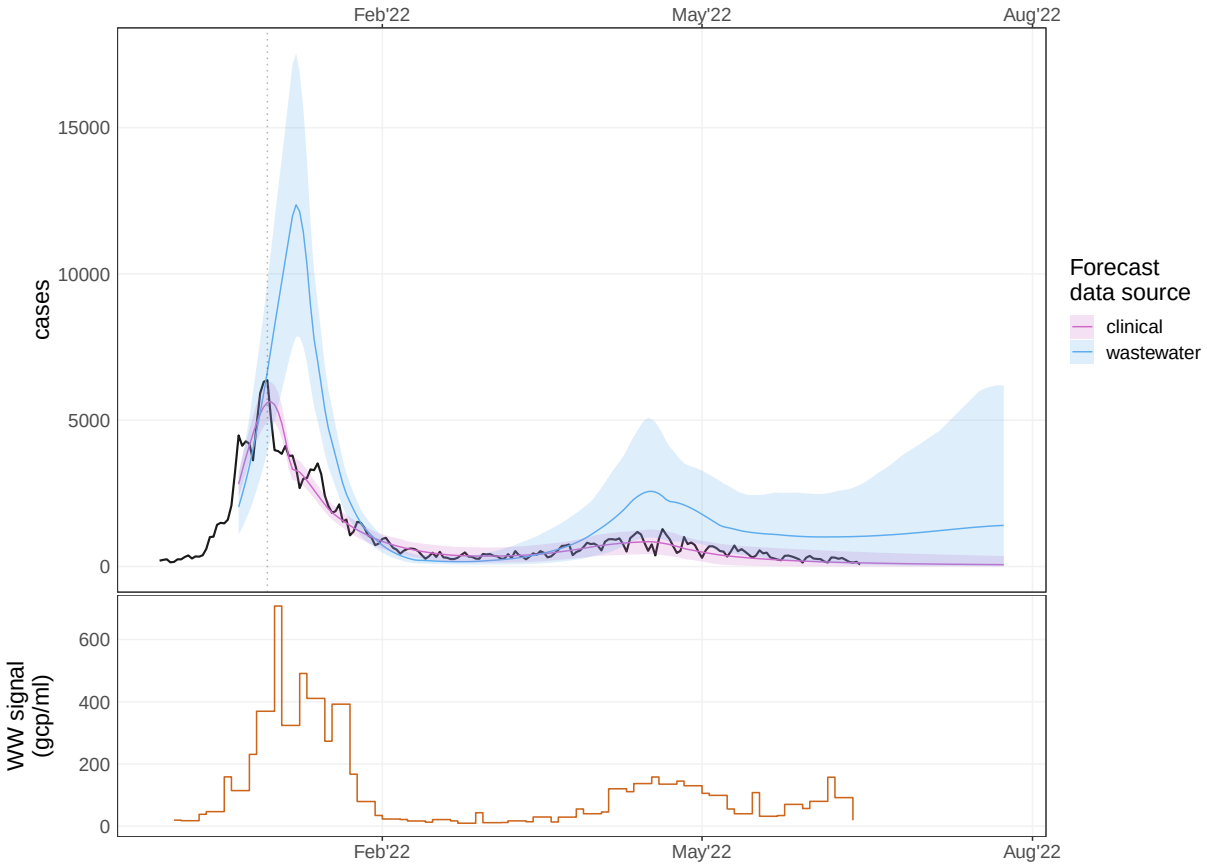
Edmonton

The modelling forecast on the wastewater signal (bottom panel, brown curve) suggests there was an increase in new cases in the community during the April/May wave. However, these cases were largely under-reported through clinical surveillance, as shown by the difference between reported clinical cases (top panel black curve) and case projections based on wastew ater signals (top panel, blue curve). Wastewater-based projections indicate a decline in the number of cases over the next few weeks.



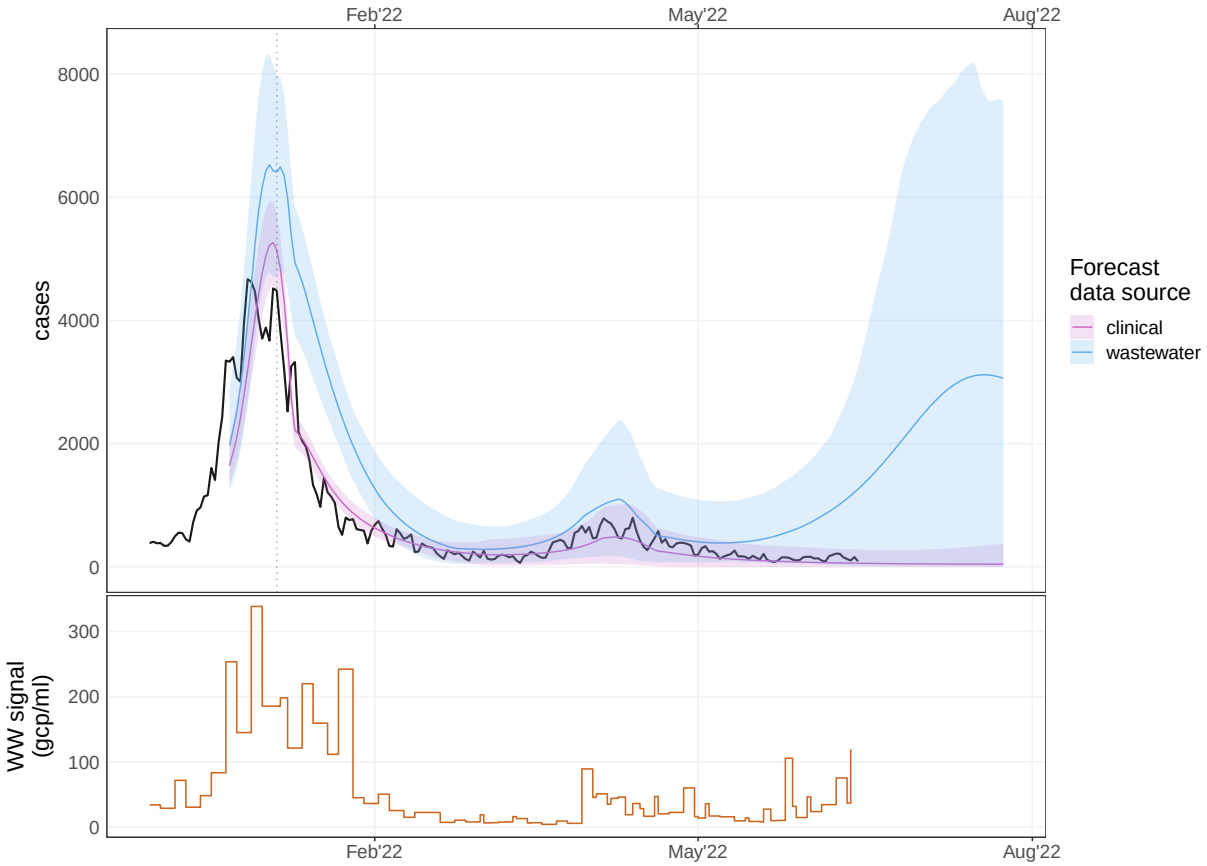
Toronto

Despite a relatively good agreement between clinical and wastewater signals between February and May 2022, the recent trend of the wastewater signal (bottom panel, brown curve) suggests a larger increase in new cases than what clinical data indicates. This is apparent in the trajectories of the forecasts, where forecasts based on wastewater signals are higher than the ones informed by clinical data (top panel, blue curve higher than pink curve for future dates). Wastewater-based forecasts anticipate an increase in the number of cases in the coming weeks.



Montreal

Clinical (top panel, black curve) and wastewater signals (bottom panel, brown curve) do not agree. Clinical data shows a low and stable number of COVID cases. However, based on wastewater data, the model has shown an increase of cases since early June. Wastewater-based forecasts suggest an increase in the number of infections in the next few weeks.



Halifax

The wastewater model observed under-reporting of clinical cases during the peak of the Omicron wave in January 2022 until early April 2022 (top panel, blue curve above the black curve). Since late April 2022, the difference between clinical (black curve, top panel) and wastewater signals (brown curve, bottom panel) has increased again indicating further under-reporting of clinical cases during May 2022.

The model suggests a sustained prevalence of COVID cases in Halifax and forecasts a decrease in the number of SARS-CoV-2 infections in the next few weeks (blue curve, top panel).