

Analysis of Wastewater

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Summary

The take-home message from the analysis of wastewater is that we are not free of SARS-CoV-2, and in particular the Omicron subvariants. We will see worrisome increases in virus leading to increases in hospitalizations and deaths. The cured will have both antibodies protecting them from reinfection for a few months and the immune-system T- and B-cells [protecting some of the population for a year or more from reinfection](#). Thus, this part of the population is free of virus required to infect others.

Unfortunately, since the virus has not disappeared, some of the population could be reinfected but should be [somewhat protected from hospitalization or death](#).

“Looking at the Northeast, where XBB.1.5 is thought to be causing the majority of infections, Michael Osterholm, who directs the University of Minnesota’s Center for Infectious Disease Research and Policy, sees reason for hope. Osterholm notes that the updated boosters should provide some protection, even against this highly immune evasive strain...It doesn’t appear to be causing any more severe illness, and so I think that it’s a very different situation circulating today than had it been a year ago,” Osterholm said. “There’s so much more immunity in the population that I don’t think that it’s going to take off.”

From the wastewater data, 50% of the U.S. population may be infected this year, and perhaps 75% to 90% could be infected by the end of 2023, so there could be considerable immunity in the population. The wastewater analysis supports this observation.

The value of wastewater analysis

Analysis of wastewater provides information on future infections. As explained by the [Massachusetts Department of Public Health](#)

“When a person has COVID-19, the SARS-CoV-2 virus is shed in their stool. A community’s collective wastewater flows to a wastewater treatment plant, where samples are taken and sent to a laboratory for SARS-CoV-2 testing...if the amount of virus in wastewater increases or decreases over several time points, that information shows that cases are either increasing or decreasing in the community. Importantly, wastewater data can provide an early warning about increasing cases since virus will show up in wastewater several days, maybe even a week, before positive test numbers start to increase.”

The value of early warning is confirmed by Biobot Network SARS-CoV-2 virus wastewater data in Figure 1, where cases follow spikes in wastewater data that can be seen in the large spike in virus in wastewater in January 2022

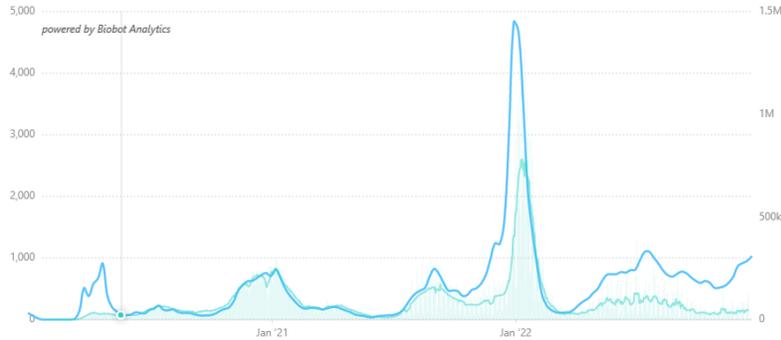


Figure 1. The SARS-CoV-2 virus concentration present in samples of wastewater taken from across the United States compared to actual cases of SARS-CoV-2. The case data was obtained from USA Facts.

The United States

A main interest is what wastewater analysis tells us about whether Omicron and its highly contagious subvariants are increasing or decreasing in the U.S. In Figure 2 is a graph of CDC data that provides percentages of wastewater sites that are increasing or decreasing from which we can make useful observations.

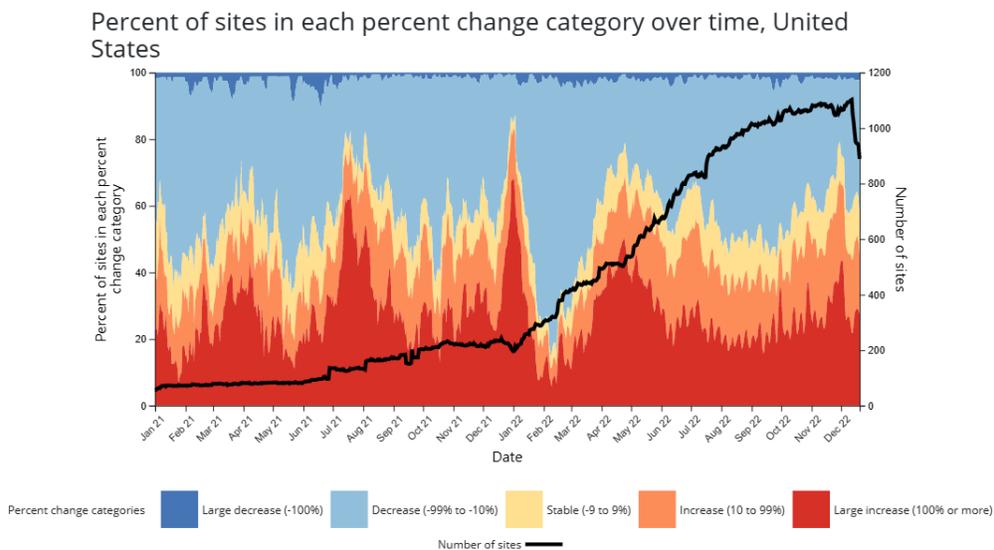


Figure 2. The percent changes in SARS-CoV-2 in wastewater (<https://covid.cdc.gov/covid-data-tracker/#wastewater-surveillance>) in the analyzed U.S sites from January 2021 to mid-December 2022.

Observations gleaned from Figure 2:

- The number of sites that collect wastewater for analysis has increased substantially over the last two years (the black line).
- Some sites show increases of virus in wastewater; others show decreases.
- From month to month there is considerable fluctuation in the data.
- A few sites show a 100% decrease of virus in wastewater; that is, virus is absent (dark blue at the top of the graph). If the virus were to entirely disappear from the U.S., the dark-blue line would extend to the bottom of the graph.
- There is also a large percentage of sites that show a 99% to 10% decrease of virus in wastewater (light blue in graph), so the virus is almost disappearing in many communities in the United States.
- Over 20% of sites show 100% or greater increase of virus in wastewater (dark red sites), indicating that virus is still present and likely will continue to be present in the near future.

More hospital admissions and deaths are anticipated in those sites that have shown large increases in SARS-CoV-2. Unfortunately, infected persons will infect others in sites that have previously shown decreases.

Boston MA and its North Shore including Gloucester

To gain more insight on wastewater analysis, Figure 3 for Massachusetts North Shore provides data.

Wastewater surveillance across MA treatment plants

LAST UPDATED ON NOVEMBER 3, 2022

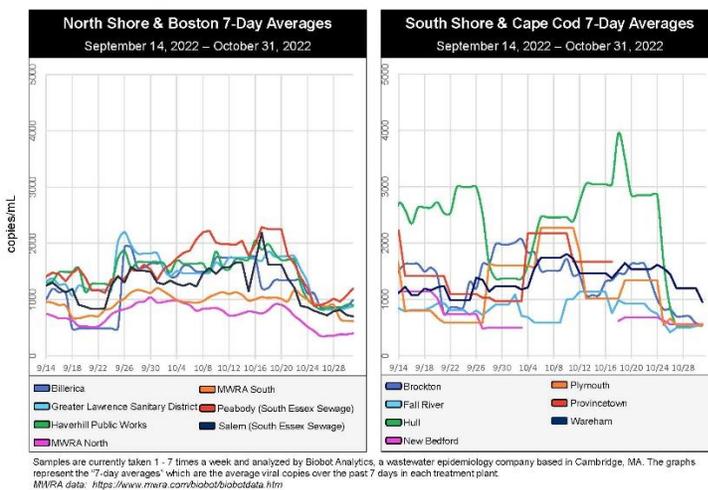


Figure 3. For the period September 14 through November 3, copies/milliliter of SARS-CoV-2 for various Boston North Shore communities are shown in the left graph. The source of the data is the [COVID-19 Wastewater Report](#) from the Massachusetts Department of Public Health.

There is considerable fluctuation from week to week, but on average the concentration of virus in wastewater remains within the range between 500 copies and 2,000 copies per ml in these Massachusetts communities. The virus in wastewater does not appear to be disappearing.

Gloucester wastewater

Since Gloucester is where the author of this study lives, [Gloucester wastewater analysis](#) of SARS-CoV-2 is of interest to him. The data for the last few years up to December 2022 is presented in Figure 4.

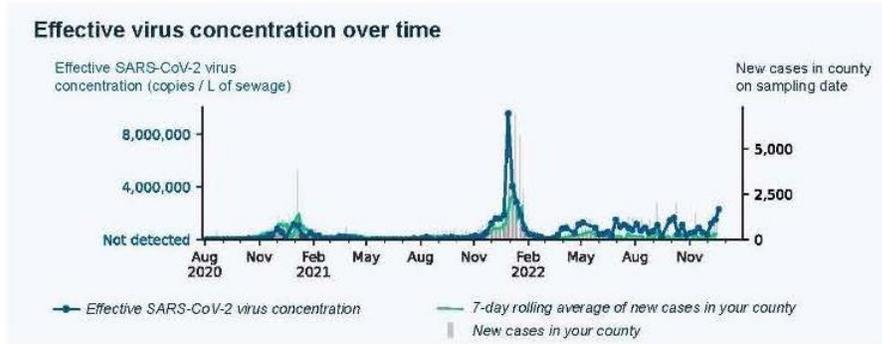


Figure 4. *Effective of SARS-CoV-2 virus concentration over time in Gloucester MA wastewater.*

The spike observed at the right-most side of the graph is disturbing, as virus has gone from not detected or nearly not detected from May 2020 through September 2021 to a spike in wastewater virus now. So, Gloucester like many communities in the U.S., is experiencing a surge of virus in wastewater that most likely will lead to increases in hospitalizations and deaths. The large spike of virus in wastewater early in 2022 is not easily explained but shows that the amount of virus in wastewater has been much greater in the past.