2022 SARS-CoV-2 Molecular Surveillance Data Report

Laboratory-Based Surveillance Program | Disease Control Bureau

Report published February 14, 2023

Key Findings

- **This report provides an overview of 2022 genomic and wastewater surveillance of SARS-CoV-2 in Chicago.**
- **6,139 SARS-CoV-2 specimens were sequenced through the Regional Innovative Public Health Laboratory (RIPHL) in 2022, which is an 144% increase from 2021.**
- **711 wastewater samples were sequenced across 12 sites.**
- **RIPHL and wastewater surveillance identified many descendants of Omicron SARS-CoV-2 lineages BA.1, BA.2, BA.4, and BA.5.**
- **In 2022, the LBS team analyzed the relationship between SARS-CoV-2 genomic and wastewater surveillance in the Chicago area. The emergence of prominent variant BA.5 shows similar trajectory between the two data sources.**
- **In 2023, CDPH will expand both genomic and wastewater surveillance, including added surveillance of pathogens of interest.**

Background

SARS-CoV-2 – the virus that causes COVID-19 – constantly changes through genetic mutation. These genetic mutations can lead to the emergence of SARS-CoV-2 variants and numerous sublineages. The Chicago Department of Public Health (CDPH) monitors SARS-CoV-2 and its variants by sequencing clinical specimens that have tested positive for SARS-CoV-2 through its Regional Innovative Public Health Laboratory (RIPHL) and wastewater samples. Monitoring SARS-CoV-2 variants helps public health officials gather important information and prepare to respond to any future change in COVID-19 transmission in Chicago. This report provides an overview of genomic and wastewater data for SARS-CoV-2 during 2022 in Chicago, and outlines future plans for 2023.

Genomic Surveillance

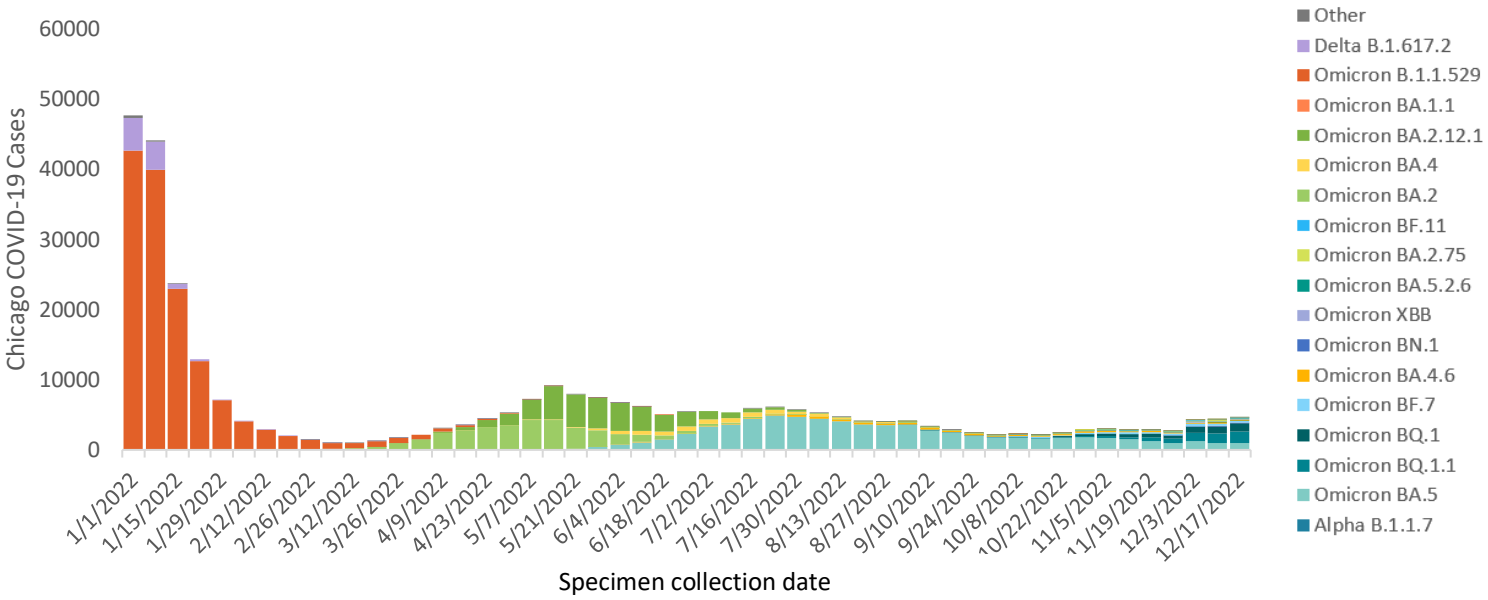
Genomic sequencing is used to identify which SARS-CoV-2 variant is in a clinical specimen. CDPH conducts genomic surveillance of SARS-CoV-2 variants like Omicron and its sublineages through RIPHL, a partnership with Rush University Medical Center. Hospitals from the Chicago area submit SARS-Cov-2 specimens to RIPHL on a routine basis, which then undergo whole-genome sequencing (WGS). The primary goal of the RIPHL is to provide timely, actionable data to CDPH for public health response.

In 2022, various Omicron sublineages were responsible for transmission across Chicago (**Figure 1**). At the end of 2022, BA.5, BQ.1, and BQ.1.1 were the most prevalent SARS-CoV-2 variants circulating in Chicago.

Figure 1. SARS-CoV-2 lineage proportions for surveillance specimens received by RIPHL, by week of specimen collection (January 1, 2022 to December 31, 2022).

Although SARS-CoV-2 variants continued to evolve in 2022, the number of COVID-19 cases in the Chicago area remain low compared to the previous year. **Figure 2** shows SARS-CoV-2 variant proportions from NS3 (HHS Region 5*) applied to the number of COVID-19 cases among Chicago residents reported to CDPH. To learn more about NS3, the CDC National SARS-CoV-2 Strain Surveillance System, visit NS3 | CDC.

Figure 2. SARS-CoV-2 lineage proportions from NS3 (HHS Region 5) applied to Chicago COVID-19 cases (January 1, 2022 to December 31, 2022).



*HHS Region 5 data includes Illinois, Indiana, Michigan, Minnesota, Ohio, & Wisconsin

In 2022, CDPH also began to monitor the growth rate of new variants of concern (VOC) or variants of high concern (VOHC) as designated by the CDC. Logistic growth rates are used to measure how quickly variants are growing in the population; quickly expanding variants likely have an advantage over existing variants due to evasion of immune responses or increased transmissibility.

This early alert signal also recognizes variants increasing in prevalence, displayed below in **Table 1**. RIPHL will continue to monitor these variants and provide updates as needed.

Table 1. SARS-CoV-2 variants currently increasing in prevalence in the Chicago area (as of January 25, 2023).

Sublineage	Parent Lineage	Date first detected in RIPHL
XBB	Recombinant of BA.2.10.1.1 and BA.2.75	9/27/2022
BN.1	BA.2.75.5 (Omicron)	10/23/2022
CH.1.1	BA.2.75 (Omicron)	11/15/2022
XBB.1.5	XBB (Omicron)	12/5/2022

Wastewater Surveillance

CDPH additionally employs the use of wastewater surveillance to monitor COVID-19 disease activity and genomic data. Wastewater surveillance is conducted in coordination with various partners including the CDC, Illinois Department of Public Health, Cook County Department of Public Health, Discovery Partners Institute, Municipal Water Reclamation District of Greater Chicago and Argonne National Laboratory. Wastewater samples are collected from 3 wastewater treatment plants that cover the City of Chicago, and from 8 sewersheds covering specific community areas within Chicago. Additionally, specific facilities are partnered with for surveillance such as local jails and nursing homes. Samples are collected from sites twice a week using a grab sample for the treatment plants, and Moore swabs for the sewershed sites.

Figure 3: Maps showing wastewater treatment plants

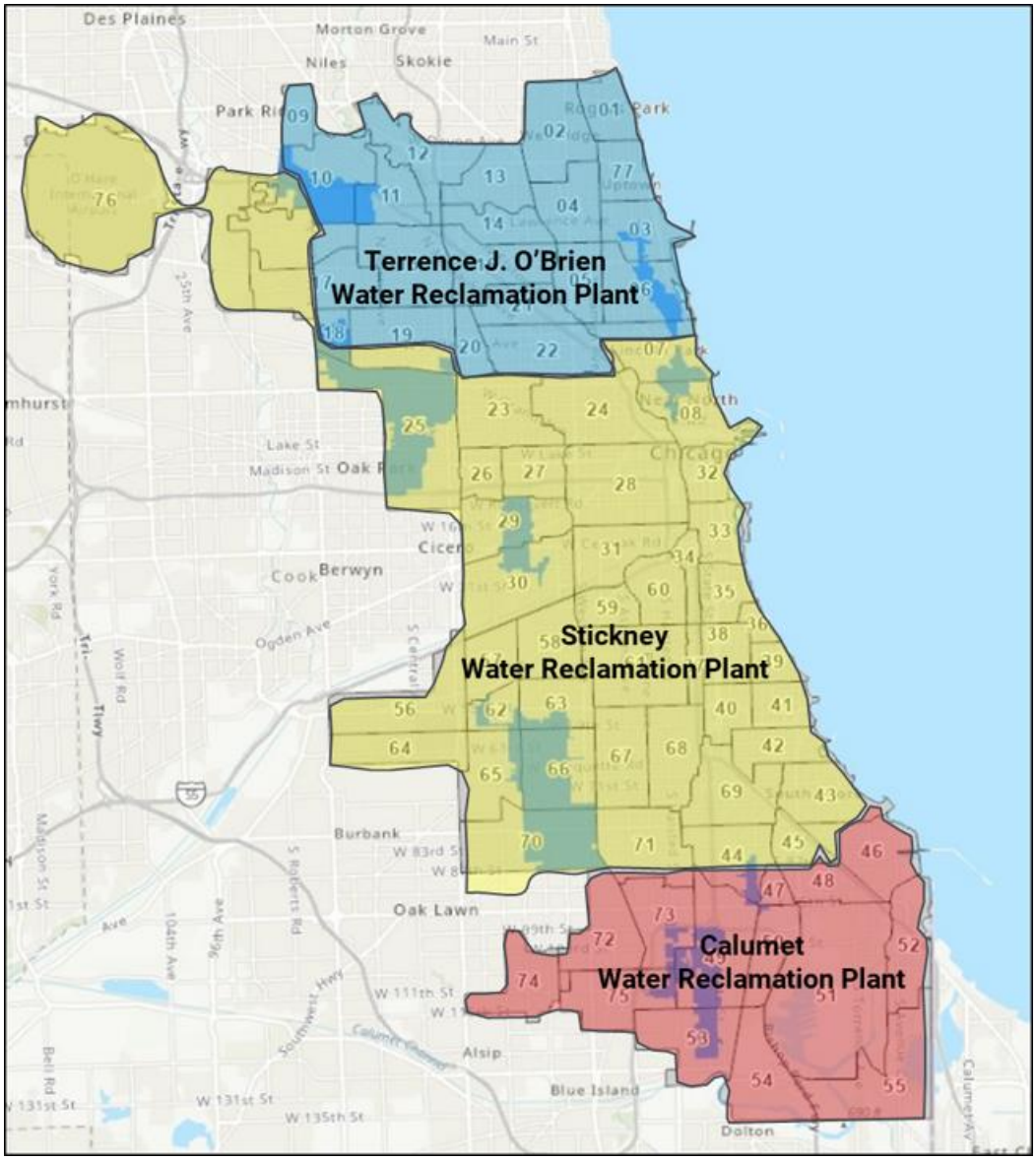
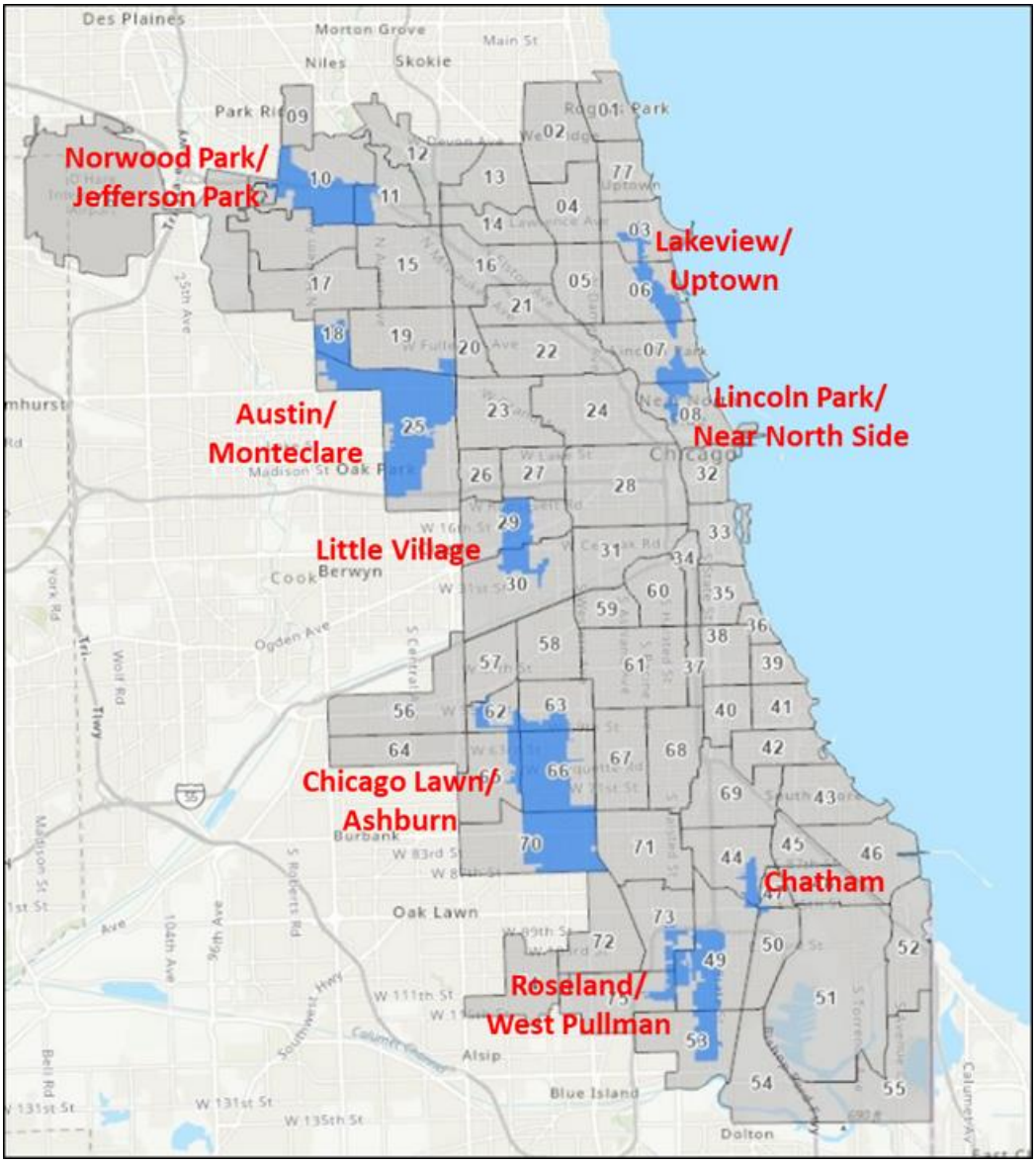
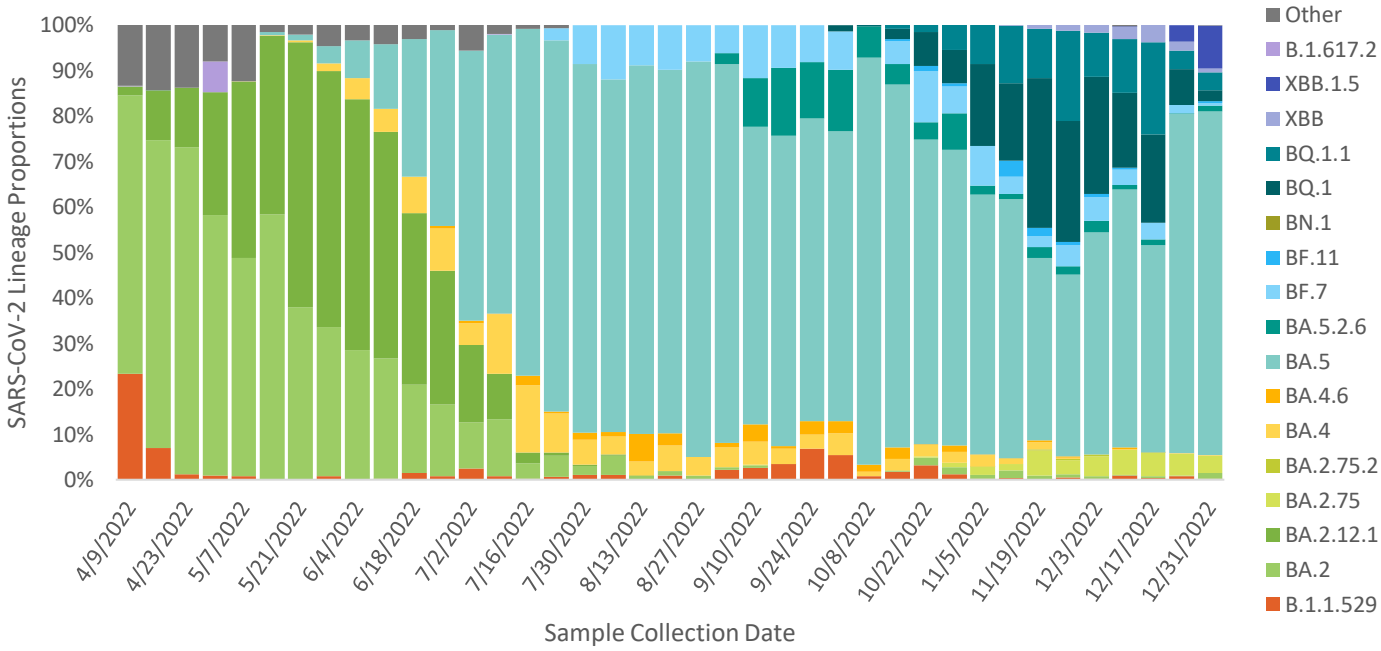


Figure 4: Map showing Chicago sewershed sampling sites



Samples from the wastewater treatment plants are sent to Argonne National lab for genomic sequencing to identify circulating variants of concern in the Chicago area **(Figure 5)**. Wastewater sequencing has revealed a similar trend to the one seen in RIPHL sequencing, albeit without a definitive transition of dominance from BA.5 to BQ.1 in the period covered.

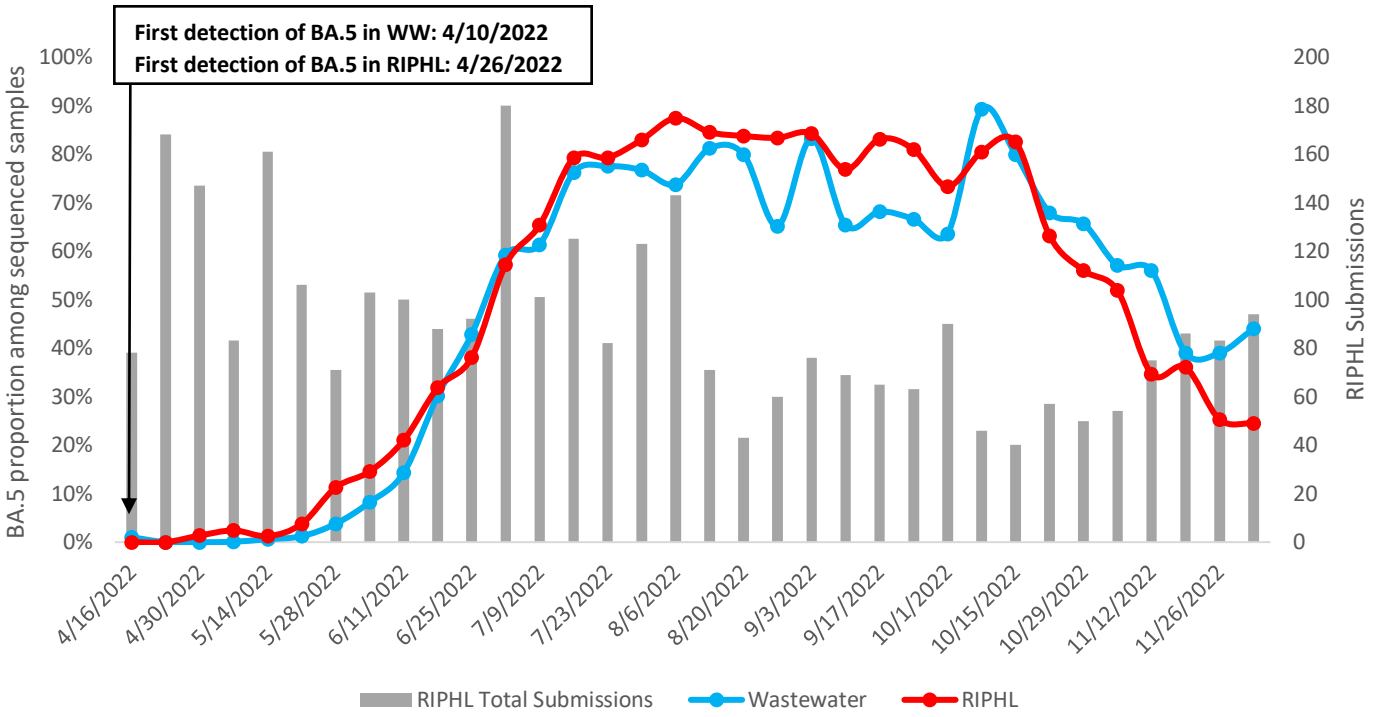
Figure 5. SARS-CoV-2 lineage proportions for surveillance sample collected from Chicago wastewater treatment plants, by week of sample collection (April 16, 2022 to December 31 2022).



Combining Genomic and Wastewater Surveillance

Although both genomic and wastewater surveillance strategies are useful in their own right, comparing them to each other can give greater insight into genomic activity of COVID-19 in Chicago. When looking at the BA.5 lineage and its emergence, detection of the first BA.5-containing specimen occurred through the wastewater surveillance system 2 weeks before RIPHL clinical specimens. Looking at BA.5's prevalence in sequenced samples and specimens over time, the RIPHL and wastewater surveillance strategies tracked similar prevalence of SARS-CoV-2 lineage over time. This good concordance provides support for both of these systems as reliable tools for variant surveillance in Chicago.

Figure 6: Accordance of RIPHL and Wastewater surveillance detection of BA.5 lineage over time (April 2022 to November 2022)



Future Plans for Molecular Surveillance

In 2023, CDPH plans to expand both genomic and wastewater surveillance. RIPHL will continue to engage with hospitals and laboratories to increase the number of specimens that are regularly submitted. Wastewater surveillance in Chicago is planned to expand to three additional pumping station sites, capturing a much larger proportion of the city. In addition, both genomic and wastewater surveillance programs are expanding to other pathogens of interest.

The LBS program has also begun collaborating with various other CDPH programs (such as healthcare settings and vaccine-preventable diseases) to support molecular surveillance for outbreak investigation response. In early 2023, air surveillance to monitor SARS-CoV-2 and other respiratory pathogens will be piloted.

Conclusions

Continued evolution of SARS-CoV-2 is inevitable, and molecular surveillance will remain critically important in the next phase of the pandemic, as well as in the evaluation of other pathogens. Wastewater surveillance can be a useful supplement to genomic surveillance of specimens, and combining data sources may provide opportunities for earlier detection of emerging lineages. As always, you can learn more about molecular surveillance at CDPH by visiting SARS-CoV-2 Variants | COVID 19 (chicago.gov) and Wastewater Surveillance | COVID-19 (chicago.gov).

Getting vaccinated remains the best way to protect yourself and others from all variants of COVID-19, including Omicron and its sub-lineages. You can learn more about current vaccine recommendations and where to get vaccinated by visiting COVID-19 Vaccine Recommendations (chicago.gov) and COVID-19 Vaccine Finder (chicago.gov).