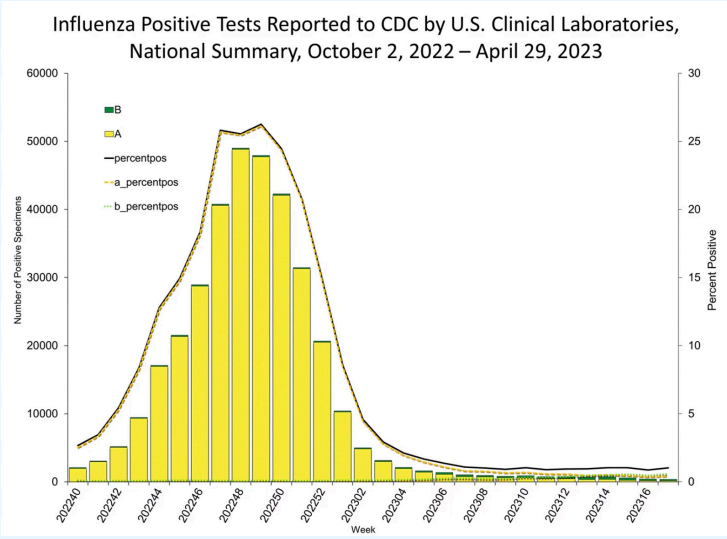
Background: Influenza A/B

Influenza A and Influenza B, colloquially known as seasonal flu or influenza, are groups of enveloped, single-stranded RNA viruses that affect about 8% of the population across the U.S. annually. Seasonal flu is a respiratory infection that can lead to a range of symptoms that vary in severity, and may include a cough, sore throat, runny or stuffy nose, body aches, and/or fever.

In the 2022-2023 season, seasonal flu caused an estimated 24-64 million illnesses, 290,000-620,000 hospitalizations, and 19,000-57,000 deaths (CDC, 2023). During the 2022-2023 season, the U.S. also observed a "tripledemic" of simultaneous influenza, Respiratory Syncytial Virus (RSV), and SARS-CoV-2 infections, increasing the need for improved disease monitoring.



Source: CDC FluView

Influenza Transmission

While only Influenza A is known to have caused pandemics, both Influenza A and Influenza B are extremely contagious and cause seasonal epidemics in the U.S. Influenza passes between people through airborne droplets most frequently, when someone sneezes or coughs. It can also be transmitted if someone touches a surface contaminated with viral particles and then touches their own mouth, nose, or eyes. People may be contagious before showing symptoms, but are most contagious in the three to four days after showing symptoms (CDC, 2023).

Influenza A is further grouped into subtypes, which are defined by its H and N surface proteins. Influenza B is further categorized into lineages, named B/Yagamata and B/Victoria, and tends to change genetically much more slowly than Influenza A (CDC, 2023). Because Influenza A genome replication is error-prone, the virus rapidly mutates and can therefore experience genetic changes even during influenza season, which might increase the number of infectious strains circulating at the same time.

Importantly, Influenza A can infect a number of animal hosts which may include birds, pigs, horses, or cats. Since only Influenza A subgroups are likely to cause a future human pandemic, which may be triggered by an animal spillover event (such as the 2009 H1N1 swine flu), the chance that a global flu event could happen at any time further supports the value of wastewater-based epidemiology (WBE) for ongoing flu monitoring.

Role of Wastewater in Flu Monitoring

Compared to other infectious diseases, national monitoring of influenza is quite comprehensive. The Centers for Disease Control and Prevention (CDC) currently monitors influenza infections through FluView, a weekly report reflecting data from clinical laboratories across all 50 states. This report shows positive tests of influenza and analyzes the viral subtypes. However, although the aforementioned statistics on the disease burden of flu are impressive, lack of testing in healthcare centers underestimates true population-level rates of flu infection. Lab testing results fluctuate based on protocols and testing sensitivities, and yearly estimates of annual flu burden are only updated after data are considered complete, which can happen with up to a two-year delay (CDC, 2023). Any substantive and unexpected changes in circulating virus would likely be observed more rapidly in wastewater than in clinical test results.

People with flu infections exhibit similar symptoms to other respiratory illnesses, and because these viruses (such as RSV, SARS-CoV-2, and rhinoviruses) can cause simultaneous spikes in cases during the colder months of the year, providers may misdiagnose the disease. Since flu is not reportable in the majority of states, WBE can play a critical role in distinguishing community-level activity of these distinct pathogens.

Additionally, the ranges of estimated illnesses and hospitalizations are wide, suggesting uncertainty. Even though weekly flu reporting to the CDC is comprehensive, individual cases of influenza are non-reportable. This contributes to a lack of clear understanding about the true disease burden of influenza. Since wastewater data includes information about all people contributing waste to a sewershed, manhole, or building, data are more likely to catch all influenza infections, unlike current surveillance methods.

Biobot and Flu

In 2023, Biobot began testing wastewater samples for Influenza A/B. In addition to existing national monitoring strategies, Biobot's ability to test for both Influenza A and B across localized jurisdictions creates another mechanism by which to track changing disease patterns across time and space. Even though flu reporting exists across the U.S., distinctions across reporting practices point to the value of a consistent monitoring strategy via WBE. The changing viral landscape (simultaneous influenza, RSV, SARS-CoV-2, and norovirus infections) underscores how WBE can improve informatics for public health, since wastewater data catches and distinguishes between these infections.

More Information

- Review the CDC's preliminary estimates of flu burden in 2022-2023 here.
- Find the CDC's weekly flu estimates here.