

Wastewater Intelligence and Application to Public Health Decisions

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Chang, 2020



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Collaborators



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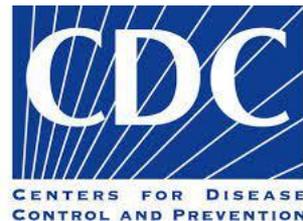
Katerina Papp



Clark County Department of Aviation

Participating Wastewater Treatment Plants

Funding



NIH grants: GM121325, GM103440, DE029954, and MH109706. CDC grant: NH75OT000057-01-00. CARES Act grant from the Nevada Governor's Office of Economic Development.

A role for cilia in development and disease

Anosmia

Cognitive defects

Retinal degeneration

Hearing loss

Craniofacial abnormalities

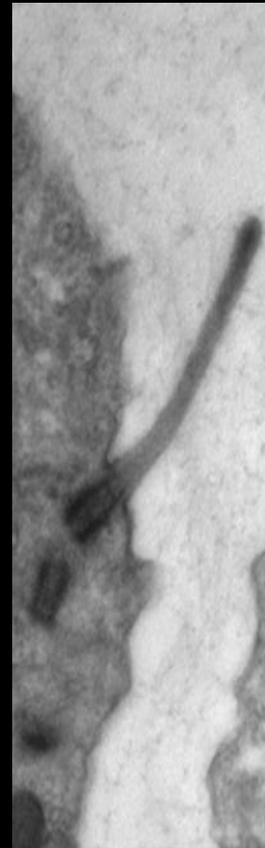
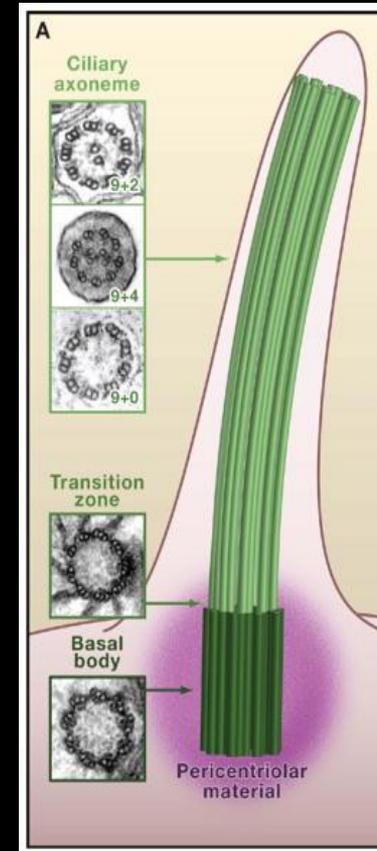
Respiratory defects

Polydactyly

Renal and pancreatic cysts

Sterility

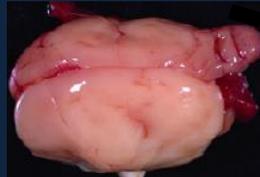
Obesity



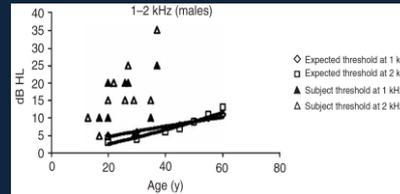
Defects of cilium have been implicated in a number of human diseases



Skeletal abnormalities



*Central/
peripheral
nervous
system defects*



Hearing loss



*Renal,
pancreatic,
biliary
cysts/fibrosis*



*Retinal
degeneration*

Genomic tools to discover mutations that cause disease

Nephronophthisis (NPHP)

Oral-Facial-Digital Syndrome (OFD)

Meckel-Gruber Syndrome (MKS)

Senior-Loken Syndrome (SLS)

Bardet-Biedl Syndrome (BBS)

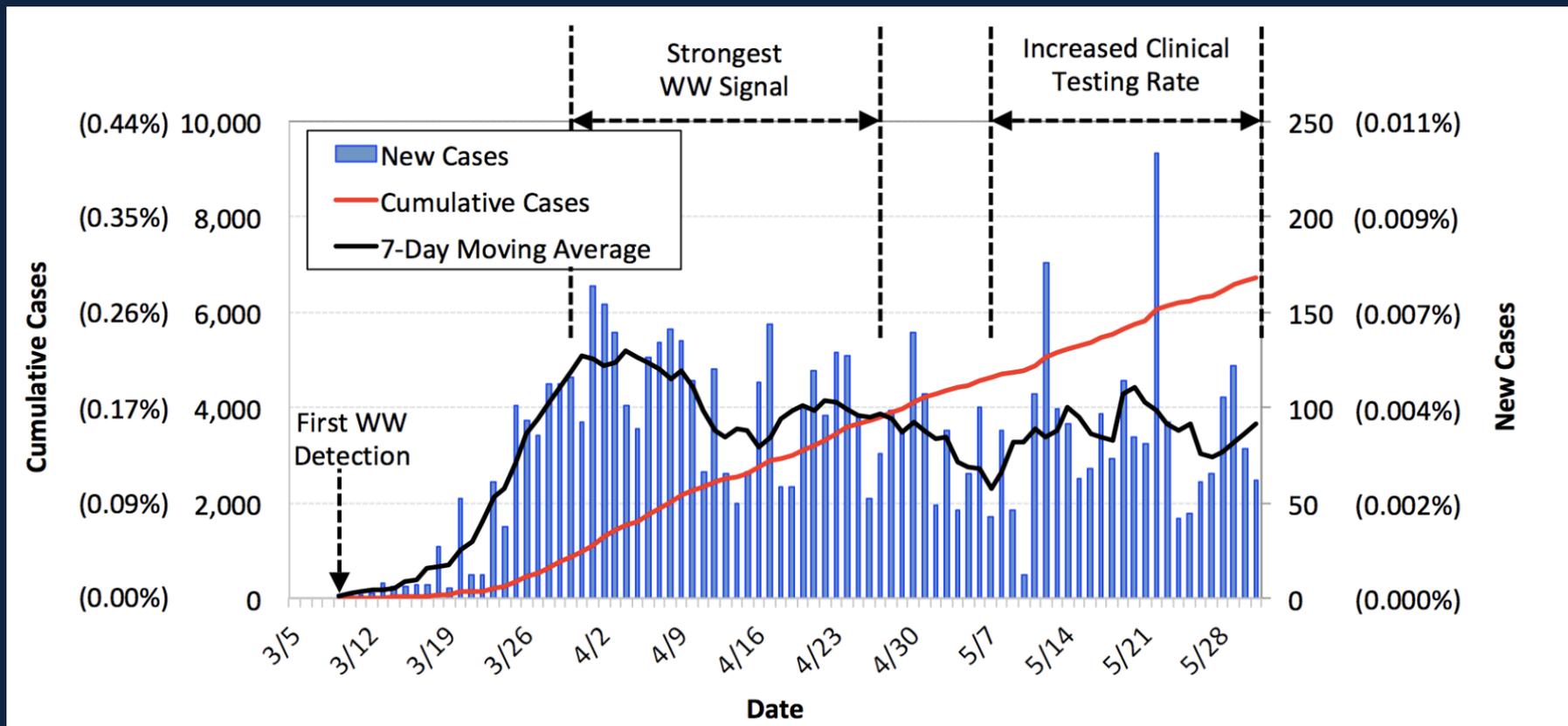
Jeune Asphyxiating Thoracic Dystrophy (JATD)

Ciliopathies: An expanding group of overlapping clinical entities

COVID-19

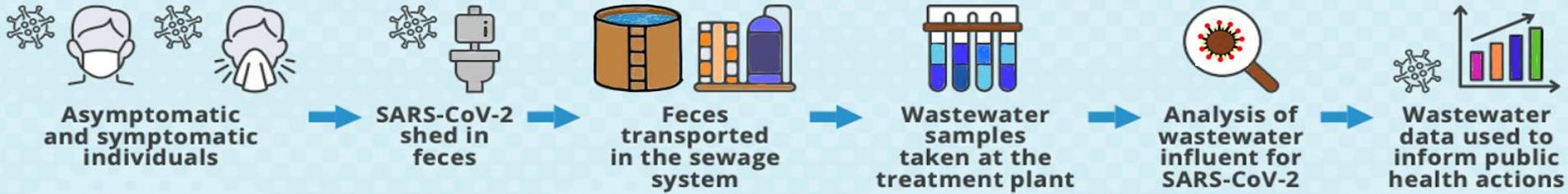
April 2020

Wastewater SARS-CoV-2 RNA levels can be used to monitor case counts



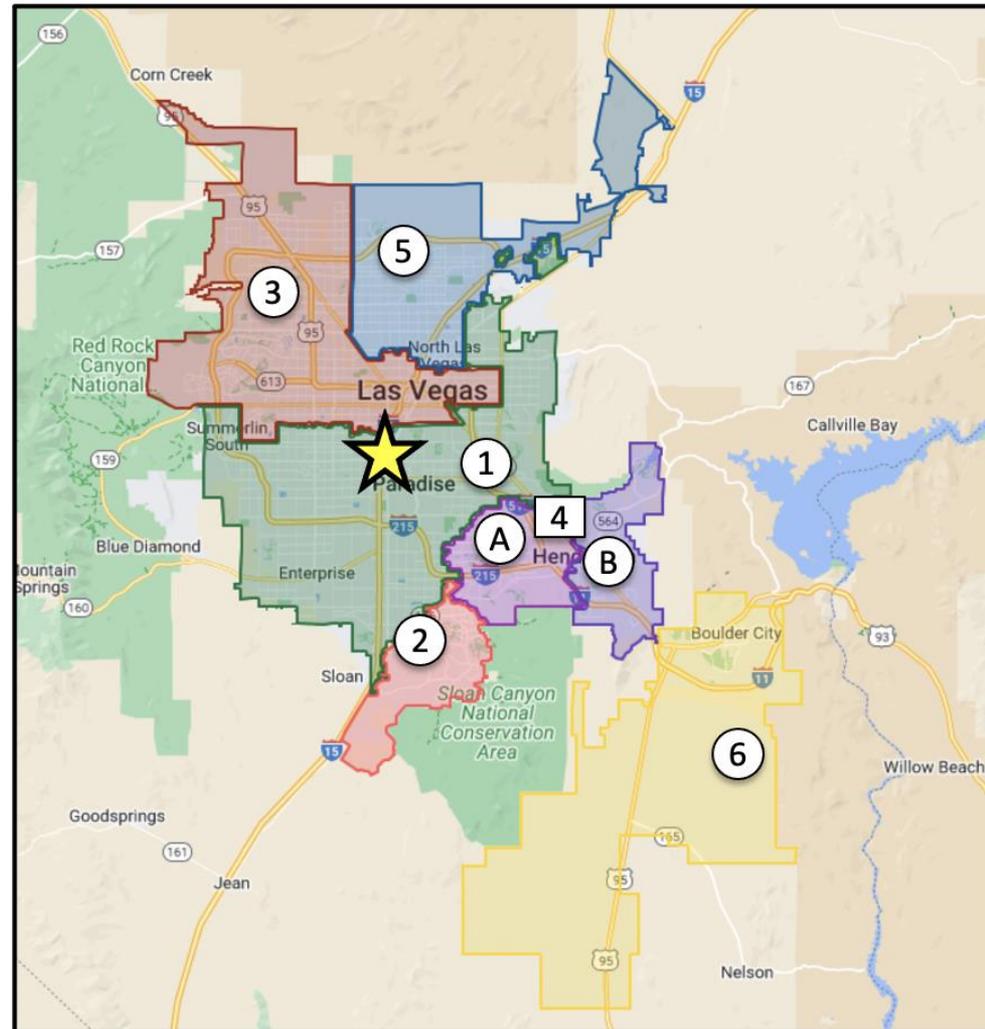
Southern Nevada Water Authority: Dan Gerrity and Katerina Papp

How it Works



Southern Nevada

Sewershed	Population	Flow (mgd)
1	900k	100
2	90k	5
3	800k	42
4 (Composite)	--	21
4A (Grab)	135k	15
4B (Grab)	115k	6
5	250k	20
6	16k	0.8





WELCOME TO THE NV EMPOWER PROGRAM

NV Enabling the Management of Public health Outcomes through Wastewater Resources

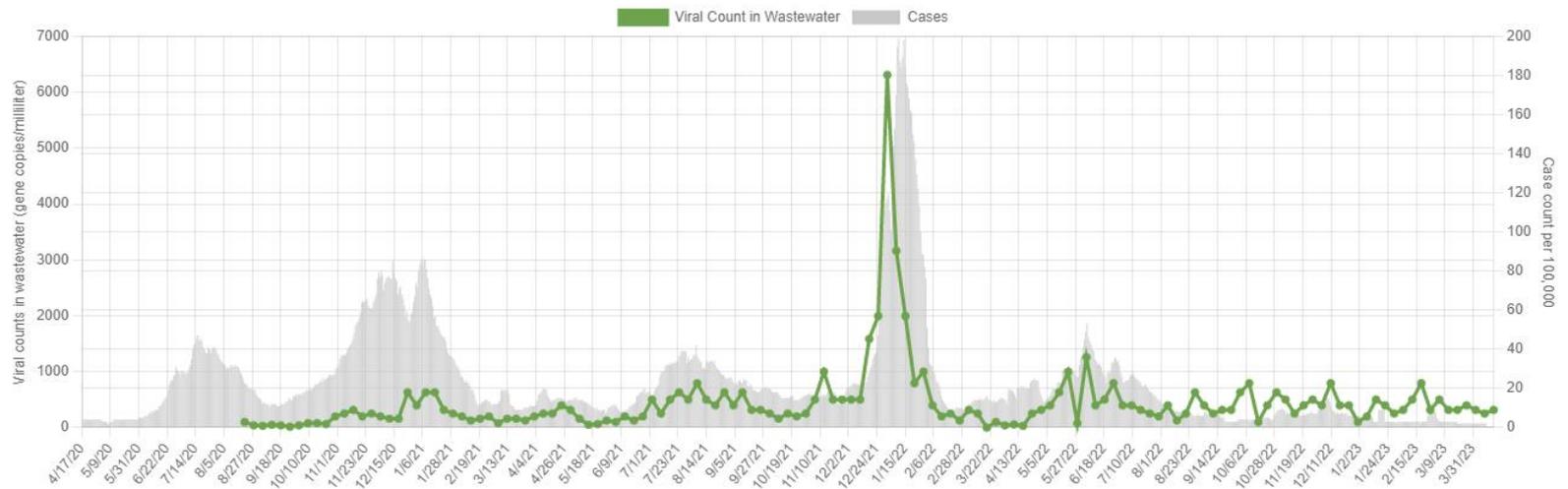
GET STARTED

Select a location on the map, then hover over the graph to see more information.



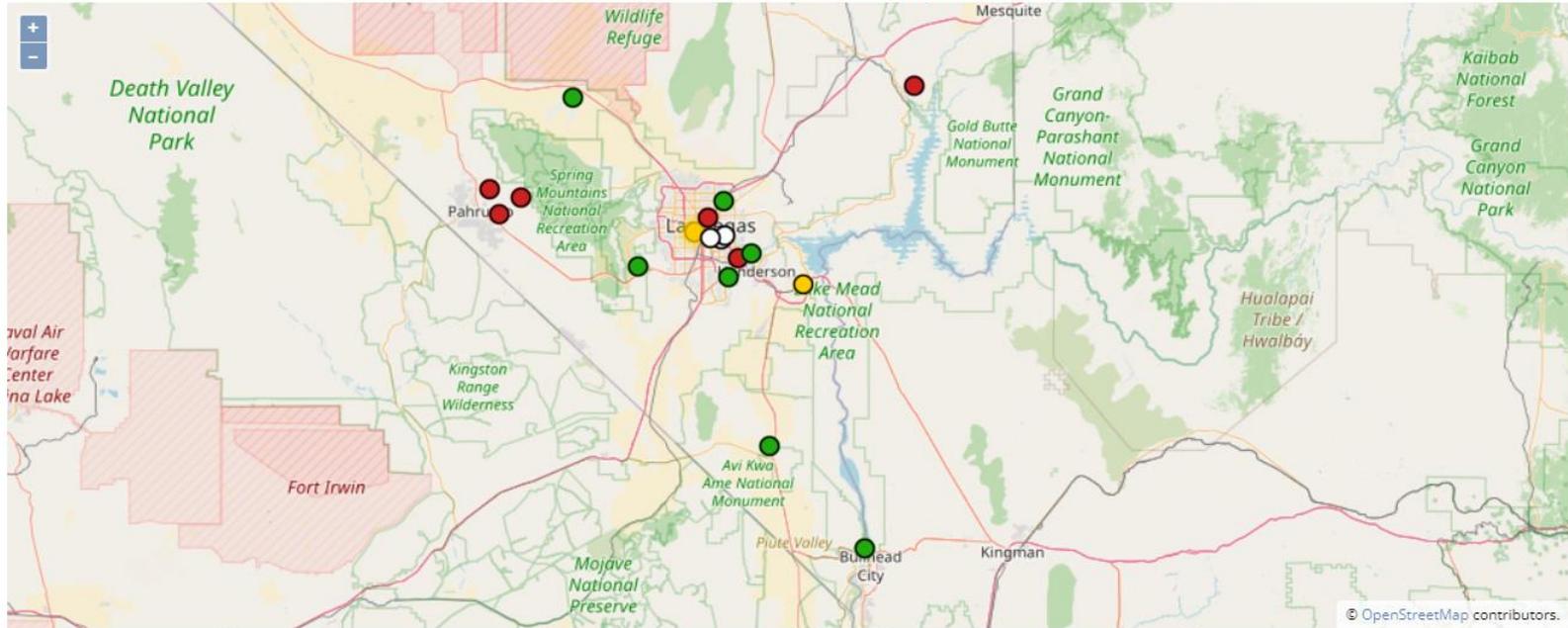
● Decreased viral Concentration | ● No change in viral concentration | ● Increased viral Concentration | ○ No data available

Clark County



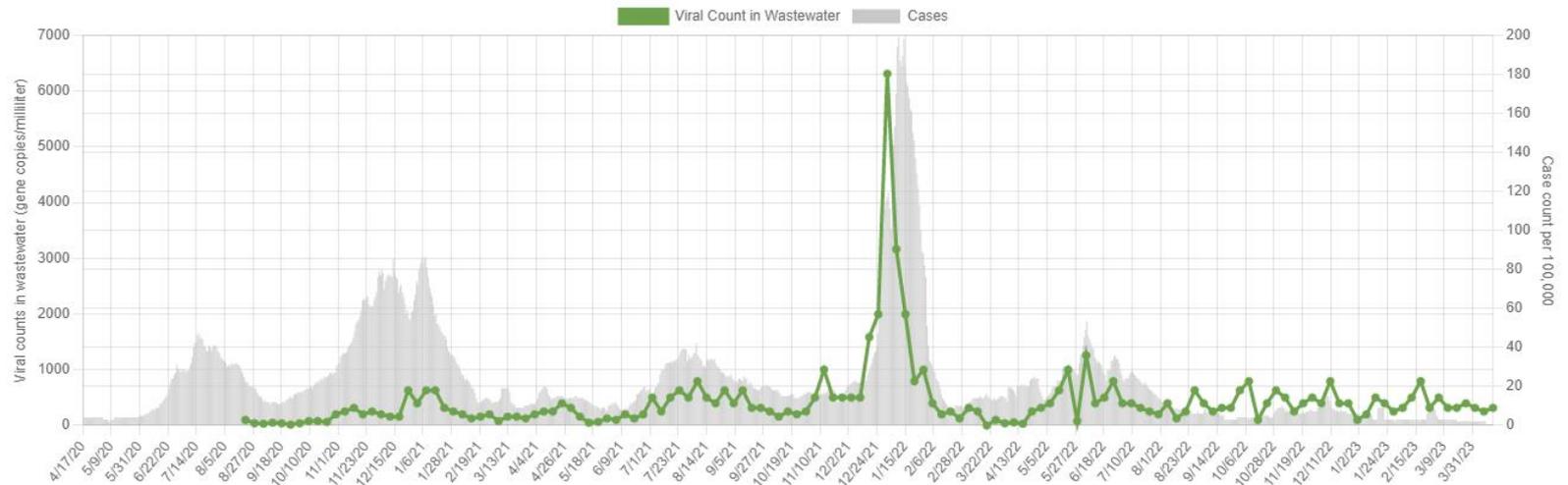
Map of Southern Nevada

Select a location on the map, then hover over the graph to see more information.



● Decreased viral Concentration | ● No change in viral concentration | ● Increased viral Concentration | ○ No data available

Clark County



Wastewater Surveillance for Policy Changes

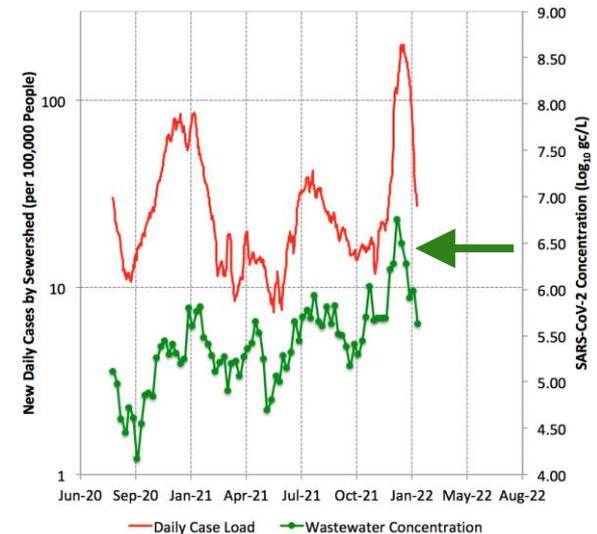
Nevada governor announces an immediate end to mask mandate



STEVE MARCUS

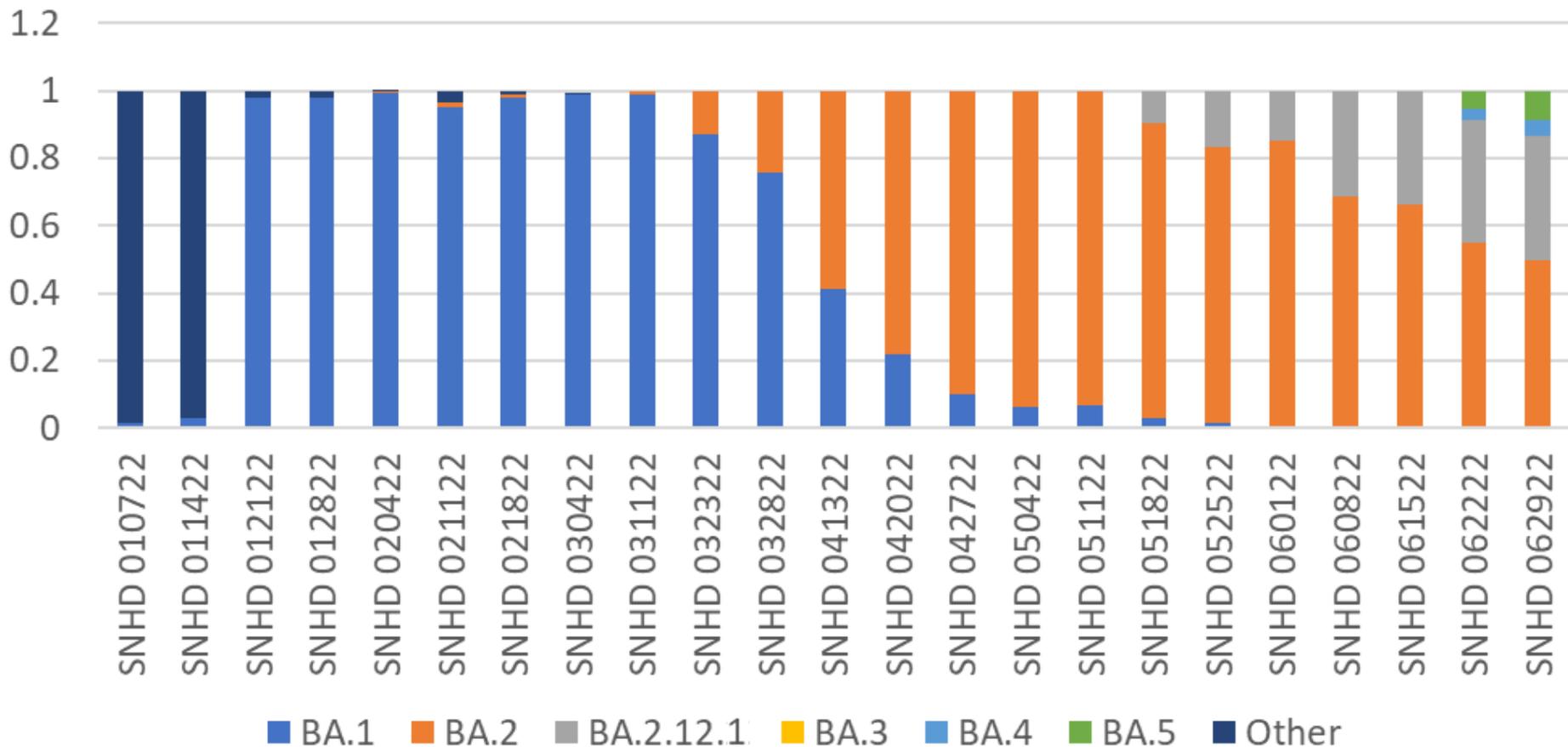
Nevada Gov. Steve Sisolak responds to question from a reporter during a visit to the Horizon Ridge Wellness Clinic on East Flamingo Road Thursday, Dec. 23, 2021. The visit was part of Protect Nevadas Future week of action, a statewide effort to vaccinate children ages 5 to 11 years against COVID-19 from Dec. 18 to 23.

In making his announcement, Sisolak cited a decline in overall cases, hospitalizations and the amount of virus detected during wastewater testing. At the height of the omicron variant surge on Jan. 10, Nevada recorded 7,865 new cases; that number has declined to about 1,280 in recent days.



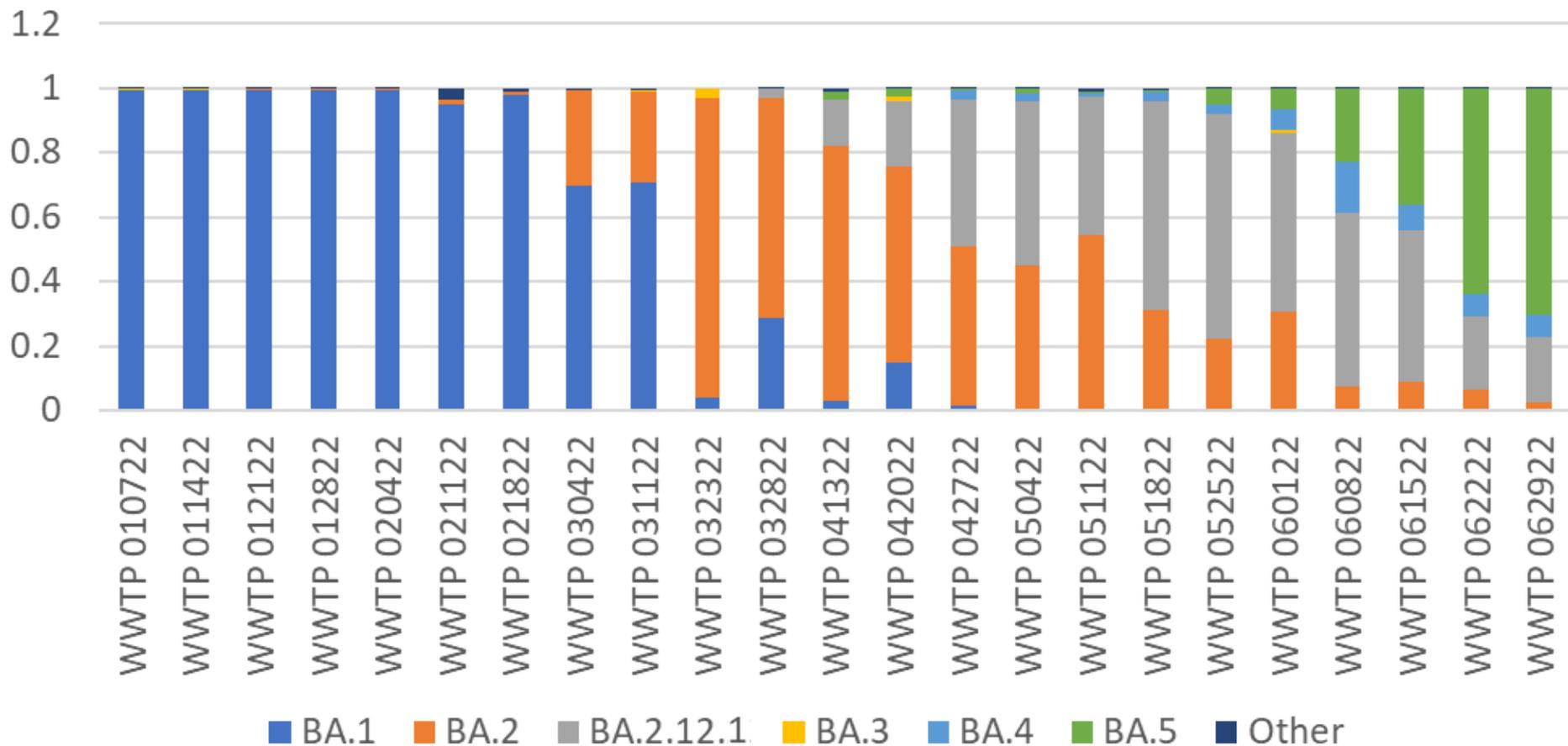
Public Health Surveillance – Southern Nevada

Variant Abundances of Reported Clinical Cases

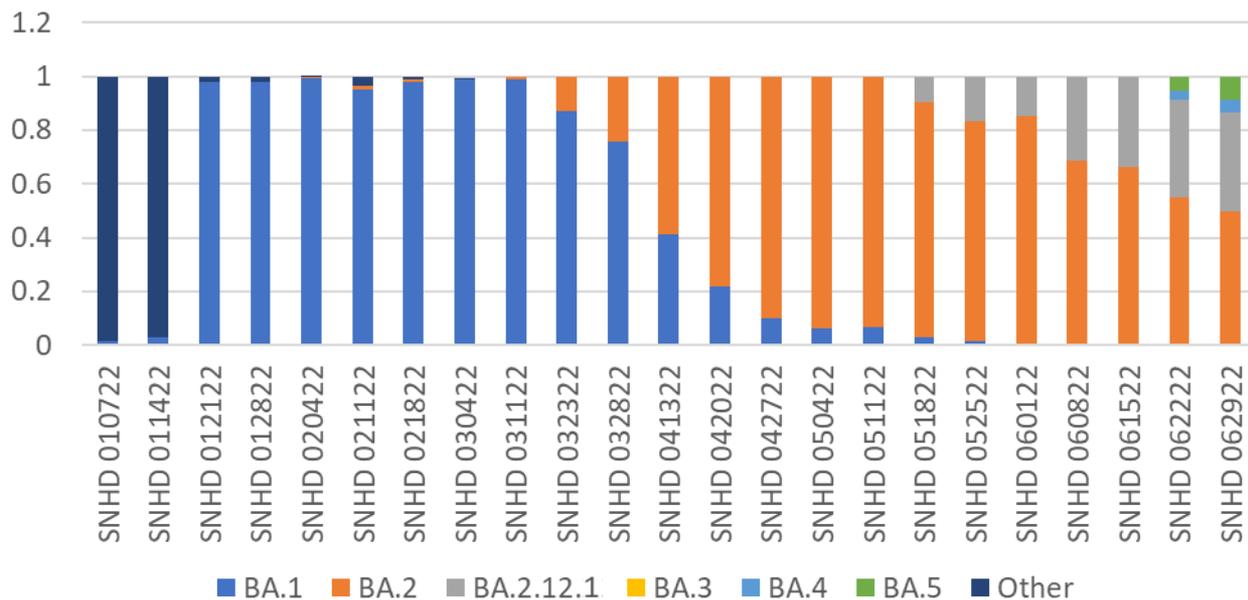


Wastewater Surveillance – Southern Nevada

Avg Estimated WWTP Variant Abundances

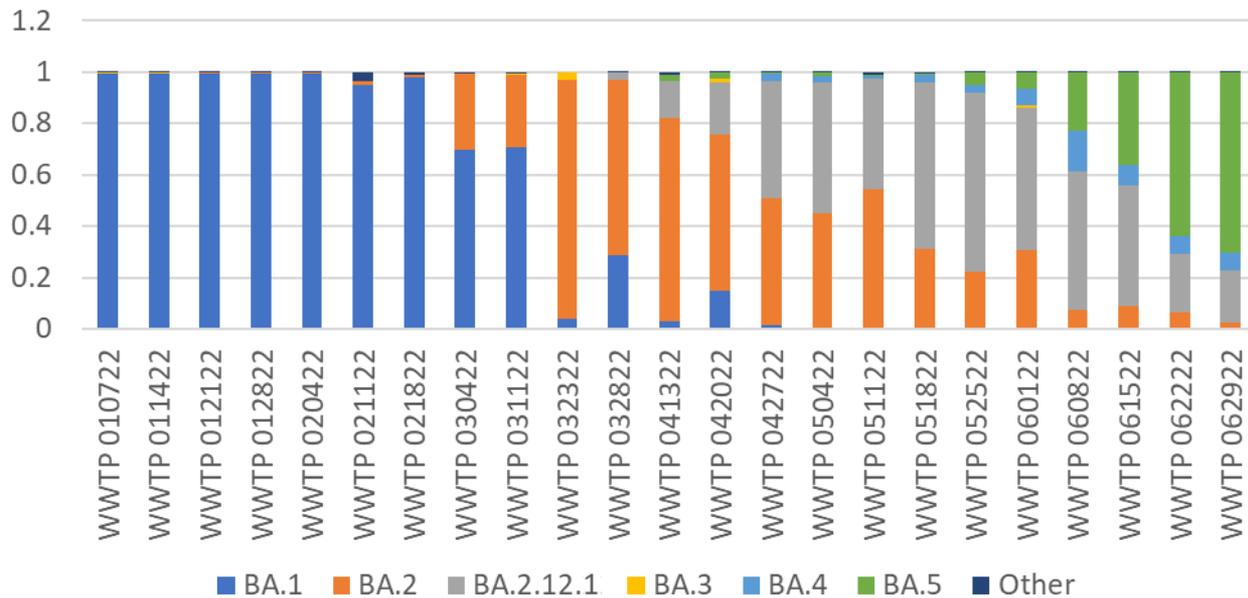


Variant Abundances of Reported Clinical Cases



Public Health

Avg Estimated WWTP Variant Abundances



Wastewater

Monitoring shelters, airports, dorms, hotels, stadiums...



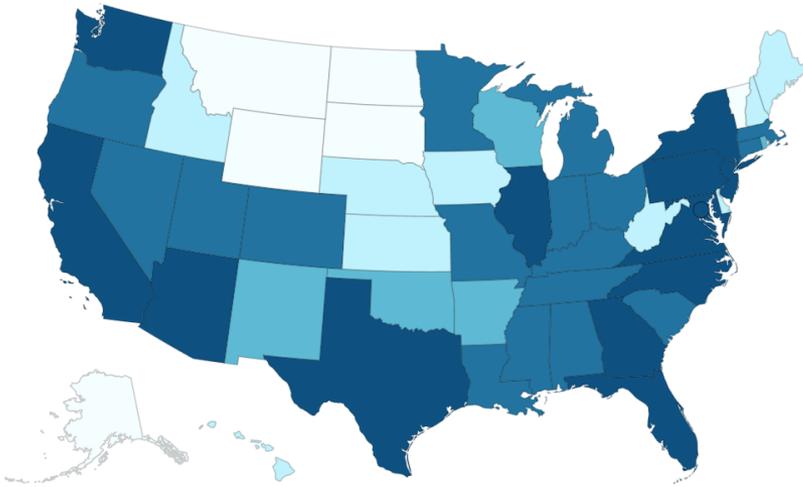
MPOX - public health emergency in 2022

U.S. Cases

Total Cases
30,193

U.S. Deaths

Total Deaths
32



Territories **PR**



Legend

- 1 to 10
- 11 to 50
- 51 to 100
- 101 to 500
- >500

U.S. Mpox Case Trends Reported to CDC

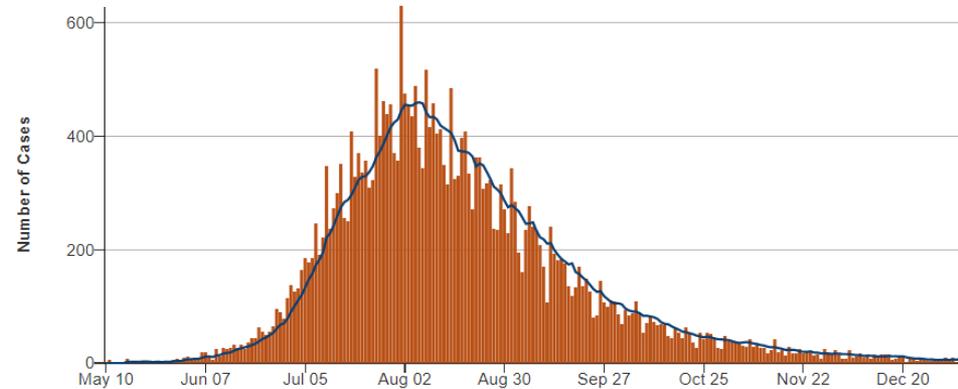
Data as Reported to CDC as of 15 Feb 2023 2:00 PM EDT

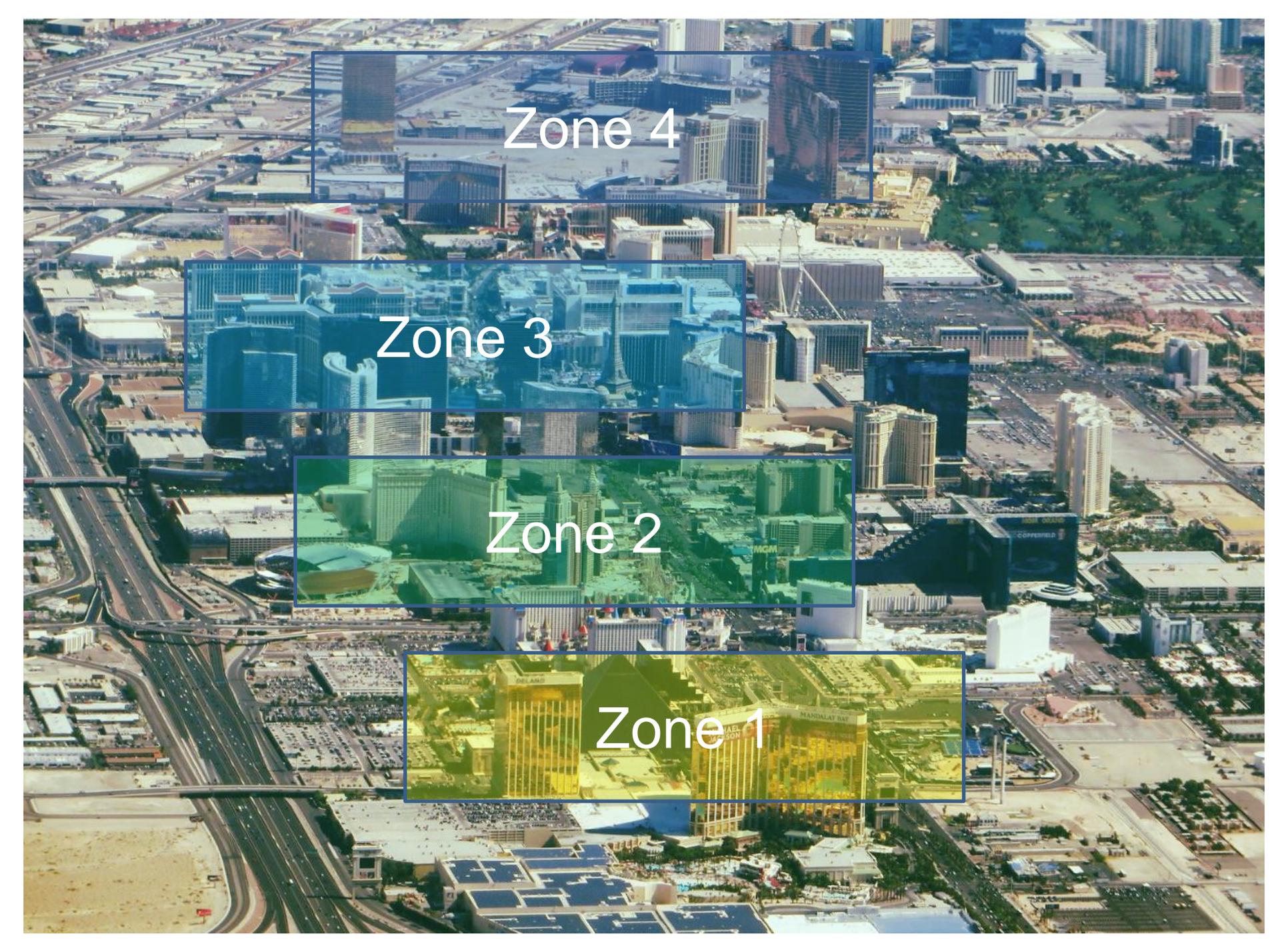
[Español](#) | [Print](#)

Beginning February 1, 2023, the data below will be updated every two weeks.

Trends of mpox cases reported to CDC during the 2022 outbreak by date*

Daily Mpox Cases and 7 Day Daily Average





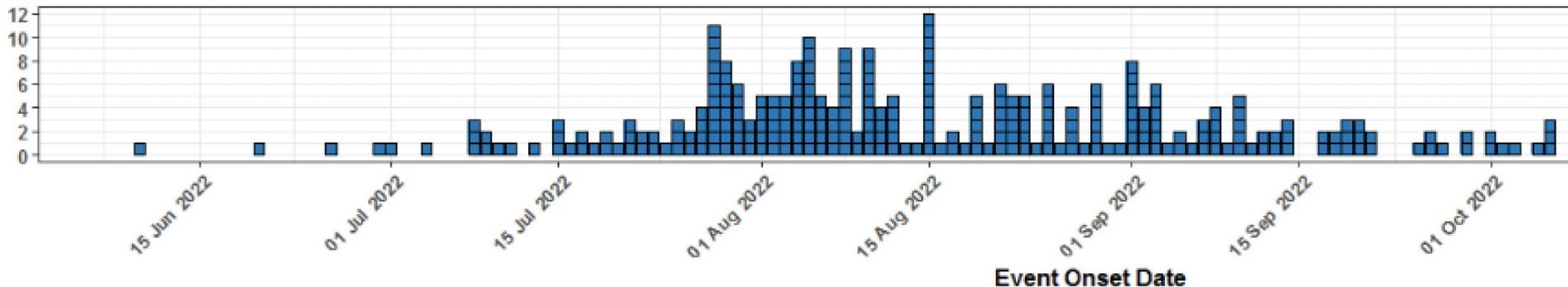
Zone 4

Zone 3

Zone 2

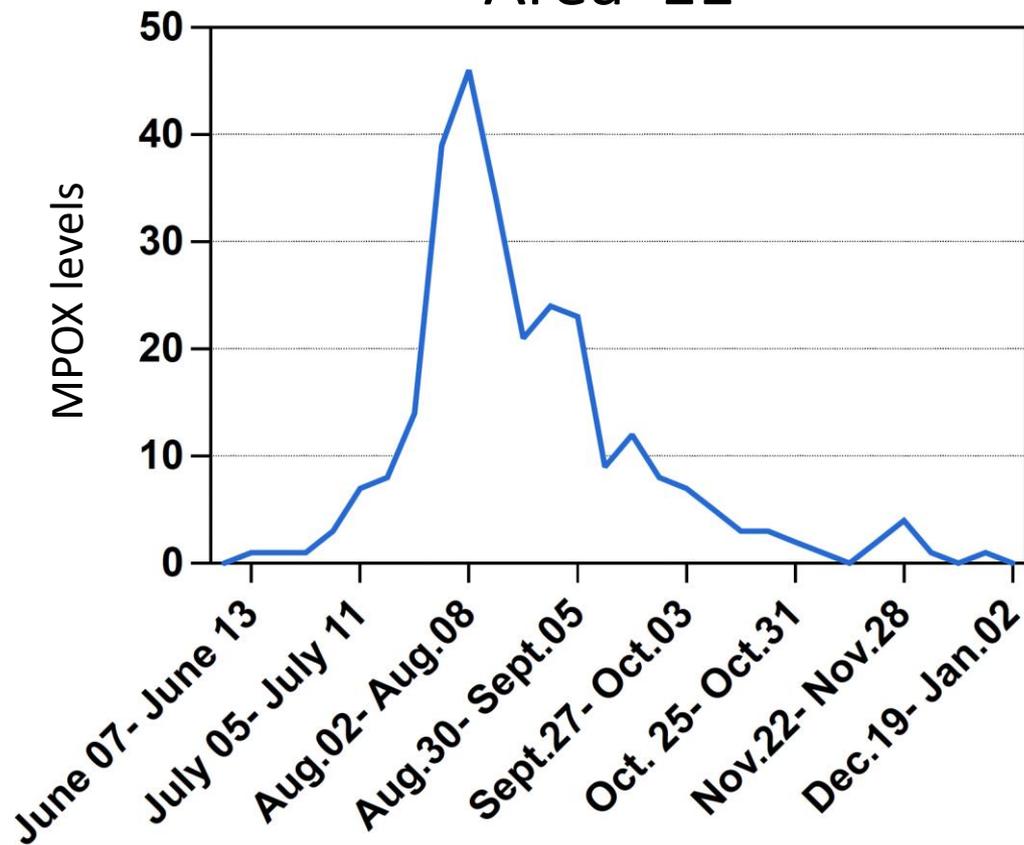
Zone 1

Case Counts by Event Date



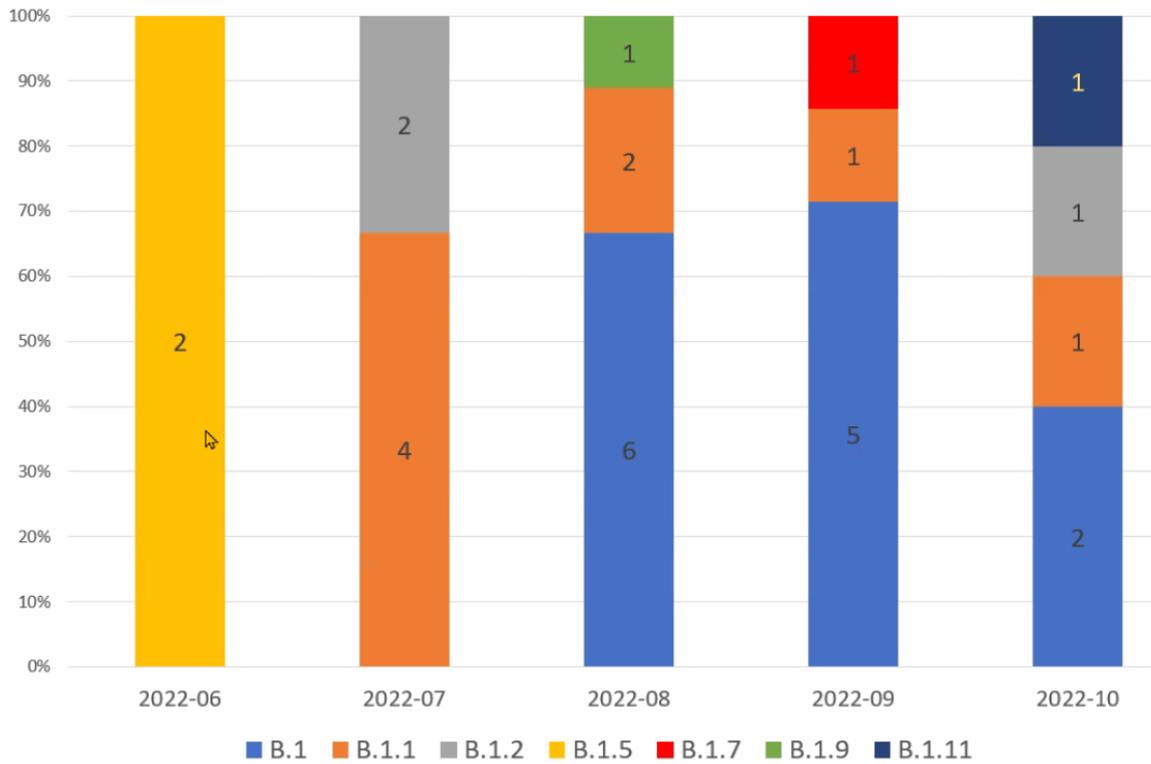
n = 286 monkeypox cases to date
Case onsets range from 10 Jun 2022 to 16 Nov 2022

Area 11

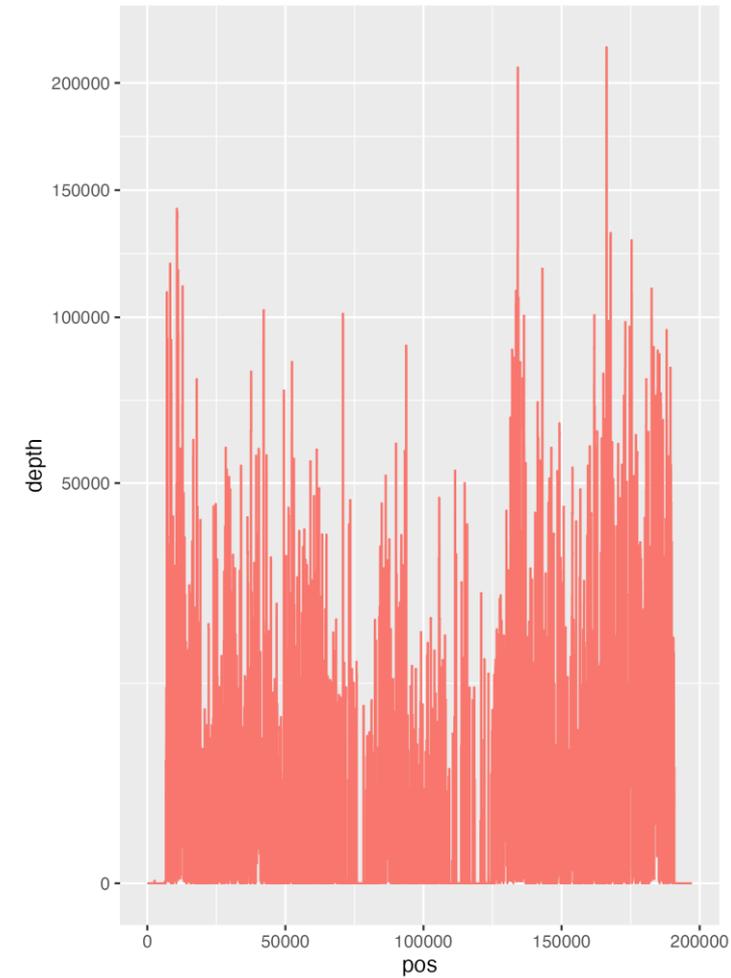


Public health and wastewater genome sequencing

Public health surveillance



Wastewater surveillance



Custom





**We're bringing immunizations
to your neighborhood**

Summary and Future Directions

- PCR and WGS from complex matrices can help determine viral load and identify variants
- Collaboration with community partners (**really essential**) to continue and grow surveillance program
- Extend program to monitor microbial content and analytes/metabolites

Questions

- What is the sensitivity of wastewater monitoring?
- How can my communities benefit from this tool?