Wastewater Monitoring for SARS-CoV-2 in the San Francisco Bay Area

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Brief history

- **May-Aug 2020:** Research in Prof. Kara Nelson's lab at UC Berkeley to optimize detection and analysis of SARS-CoV-2 in wastewater
- **June-Sept 2020:** Initial interest towards regional monitoring effort, beginning of routine monitoring and coordination with public health departments about sampling strategy
- **October-present 2020:** "Pop-up" laboratory for routine monitoring launched, expanded number of sites and frequency of sampling

Covid-WEB

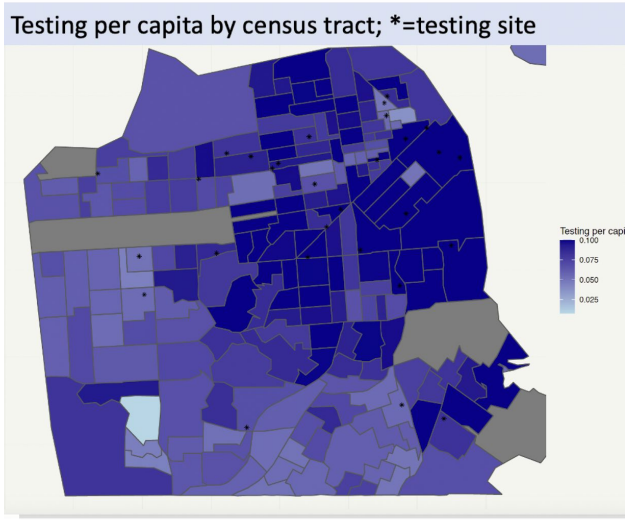
Wastewater Epidemiology for the Bay Area

Partnerships

- 38 sampling sites (1-3 times per week)
- 18 wastewater agencies
- 5 county public health agencies
  - Reporting to California Dept of Public Health
  - Coordination with CA Water Board
  - Data will be entered into CDC-NWSS database

Wastewater Monitoring Potential Advantages

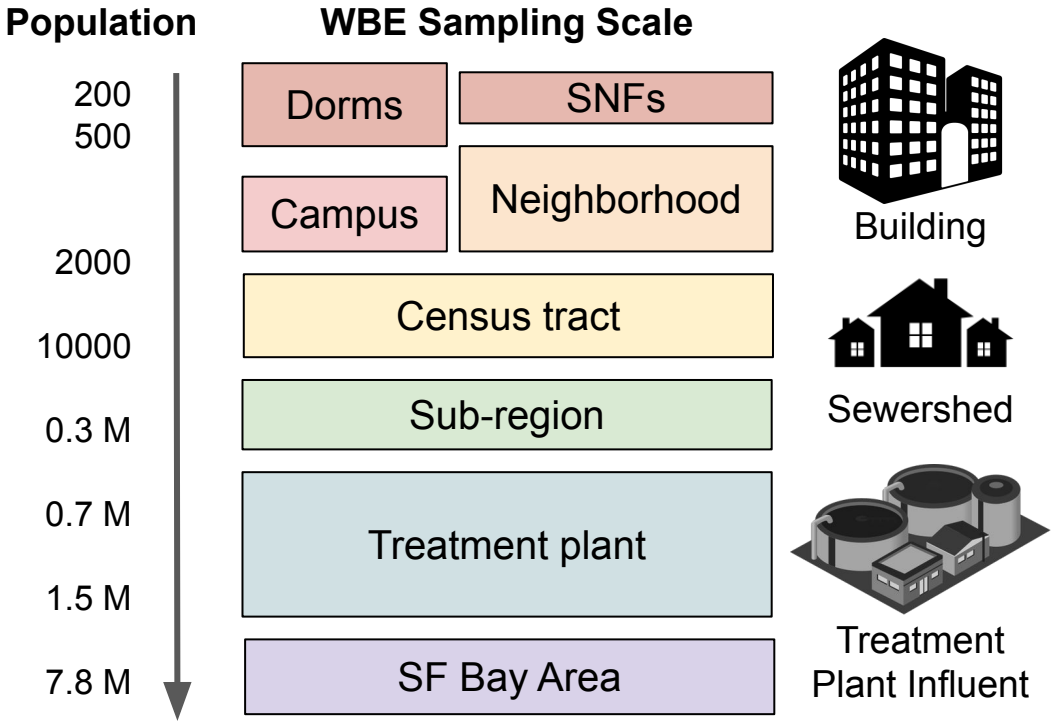
- Less biased than individual case data (unequal access to testing)
- May provide an earlier signal, especially when testing turnaround time is slow
- Inherently pooled sample



Individual testing rate varies widely across populations

Image credit: Maya Petersen, UCB School of Public Health and SFDPH

How can wastewater help us manage the pandemic?



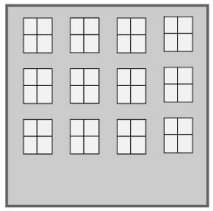
Public Health Application

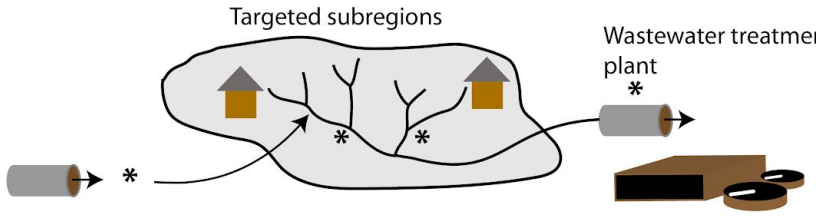
Rapid response: test, trace, isolate; reward and reinforce

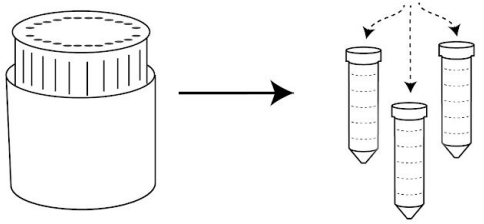
Compare trends across neighborhoods
Deploy targeted response in communities
Engage community
Test effectiveness of interventions
Identify hot spots

Genetic sequencing to identify viral strains
Notify hospitals of upcoming surge
Relax/increase shelter-in-place restrictions
Confirm low prevalence
Integrated regional decision making

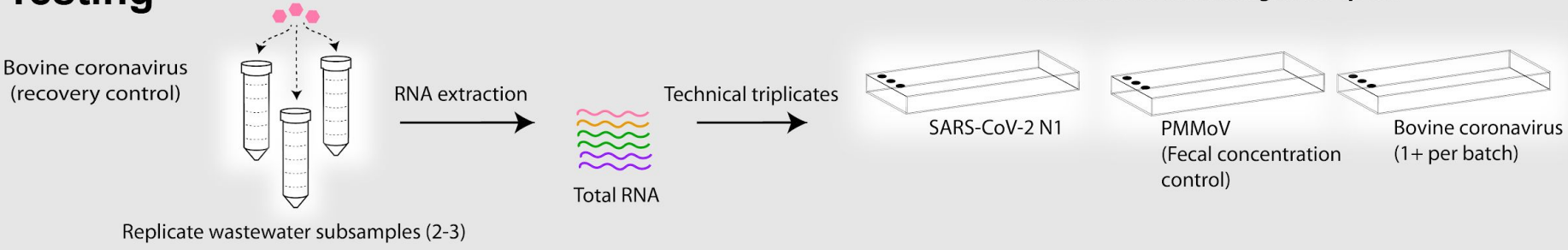
Sampling



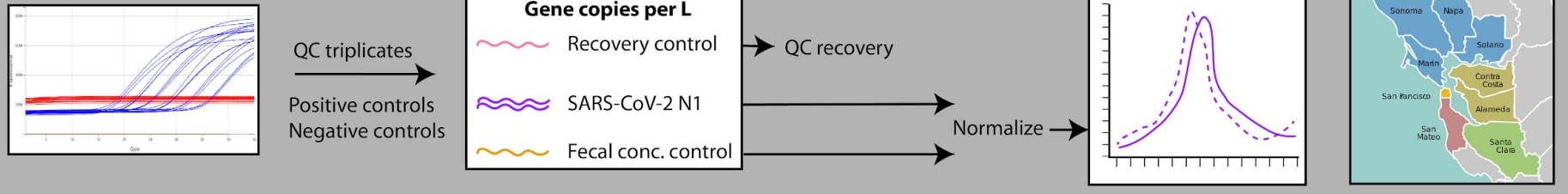




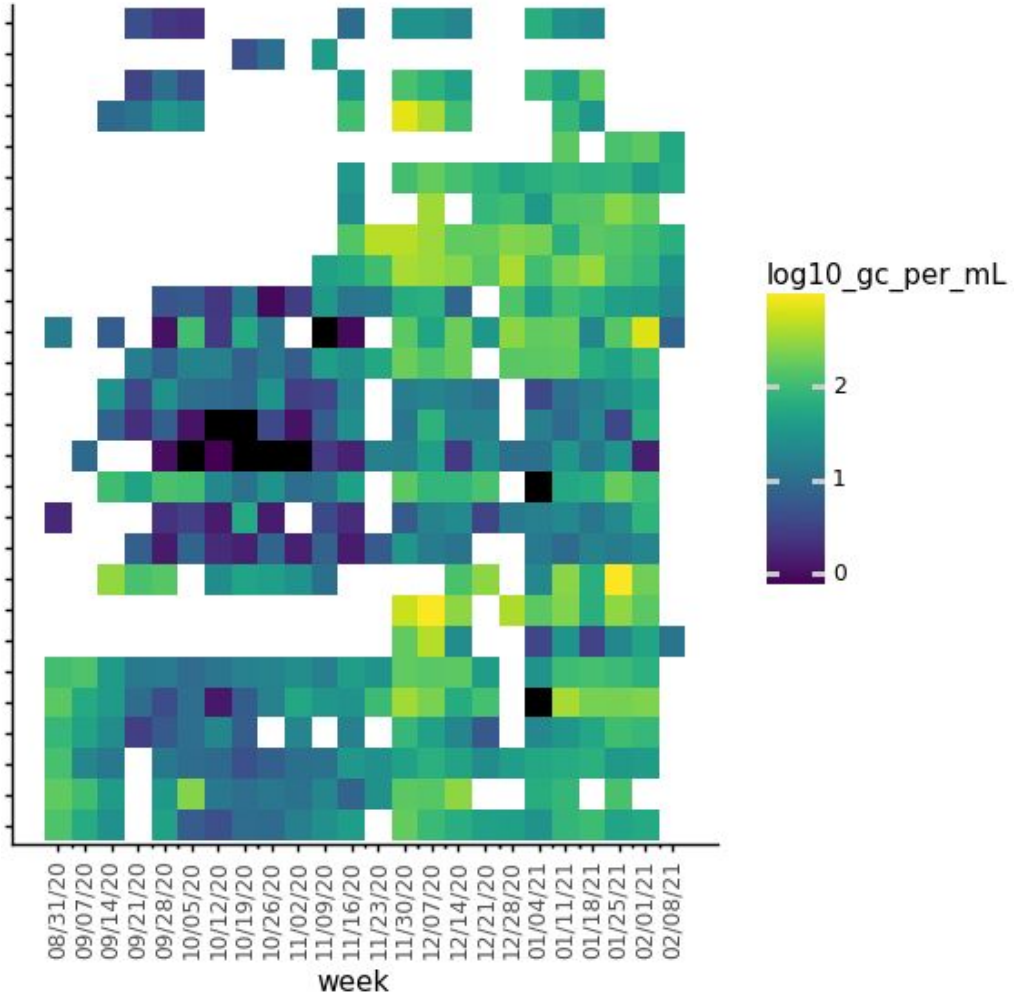
Testing



Data analysis

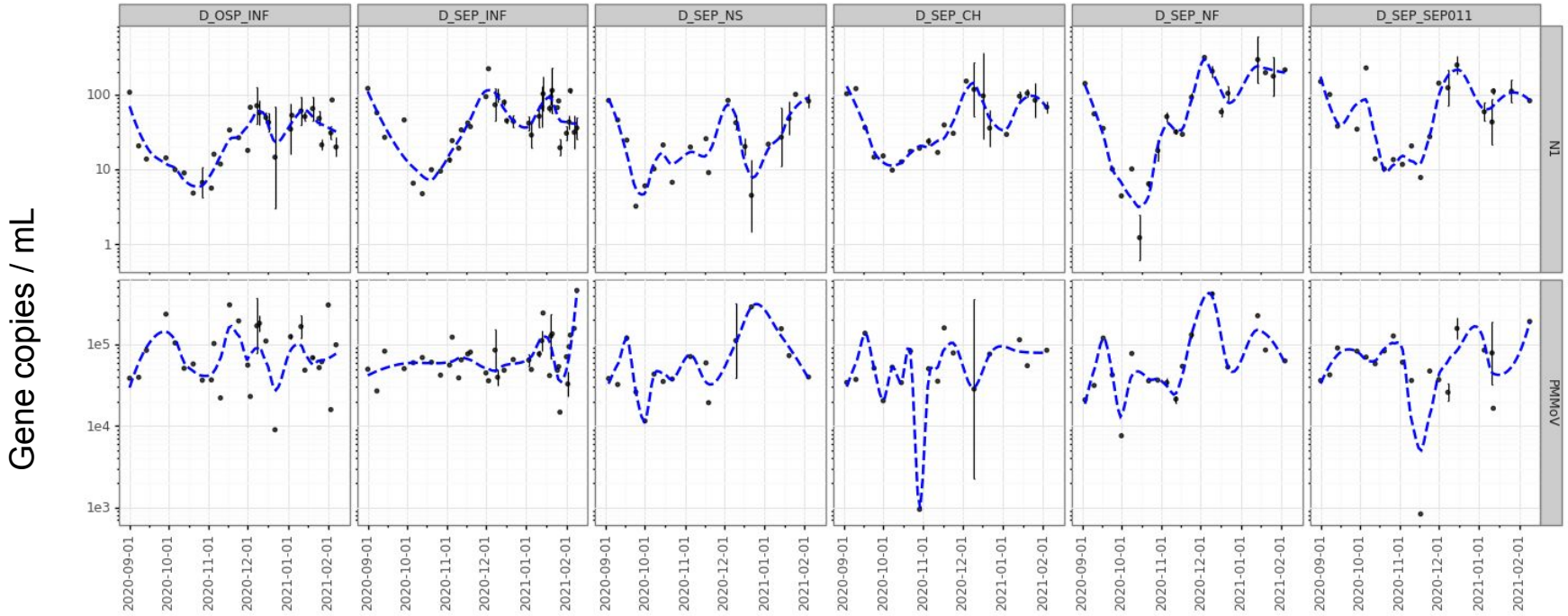


Results from across the San Francisco Bay Area

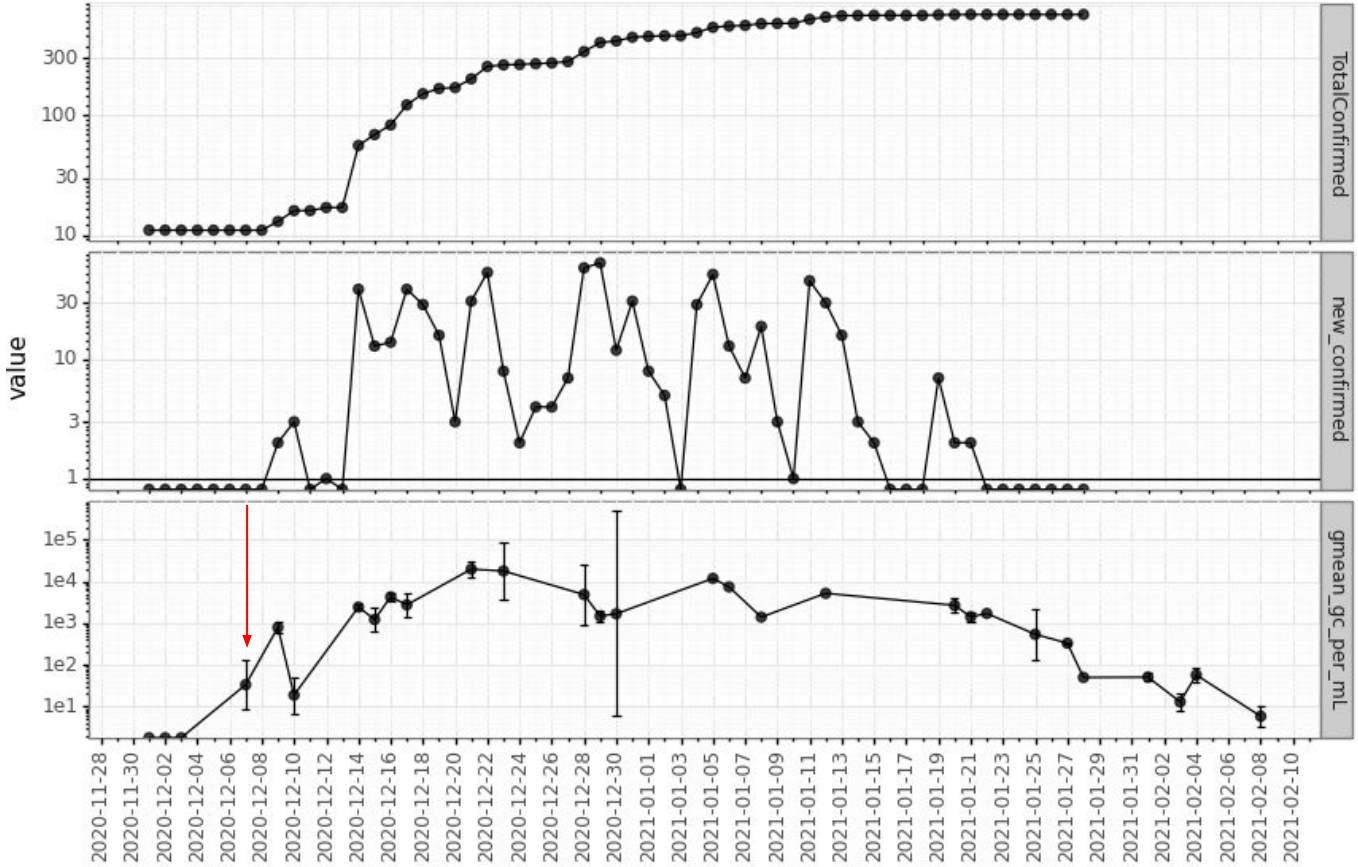


San Francisco Results

Plant 1 Plant 2



Outbreak in a residential facility: early detection



Wastewater data interpretation challenges

- Mismatches to case data are expected
  - Viral load (quantitative) vs. binary case data (positive/negative)
  - Undertesting and asymptomatic cases
  - Changing lag between wastewater and case
  - Sampling is limited to 1-3 times per week, depending on staffing
- Fecal shedding patterns: incidence vs. prevalence
  - Log scaling improves correspondence to case data
- Combined sewer systems and changes in flow
  - Fecal concentration changes: PMMoV, crAssphage, flow, TSS

Ongoing work

- Regional dashboard for data visualization
- Lab blueprint paper
- Sequencing to detect new strains (Crits-Christoph et al, 2021 mBio)
- Fecal concentration controls comparison (Greenwald & Kennedy, in prep)
- Passive sampling via low-cost swabs
- Comparison of case data to wastewater data

www.covid-web.org
https://news.berkeley.edu/2020/10/29/uc-berkeley-launches-pop-up-lab-to-monitor-bay-area-sewage-for-covid-19/