# WASTEWATER MONITORING OF HIV-1: FEASIBILITY AND COMPARISON TO SURVEILLANCE DATA

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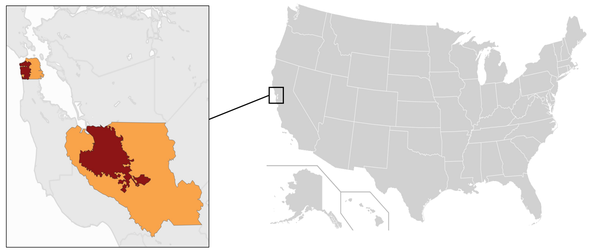
## BACKGROUND

Targeting screening on high-risk communities is a critical component of the CDC's Ending the HIV Epidemic initiative. Wastewater-based epidemiology can identify and quantify infectious agents circulating in communities without the need to test individuals. Measuring HIV in wastewater (WW) appears feasible, but has not been used for monitoring HIV in communities.

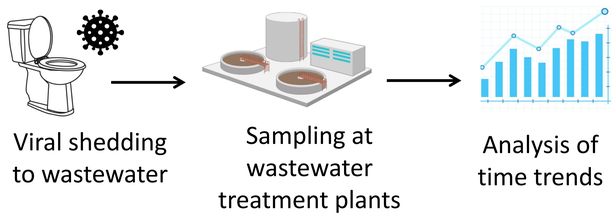
## METHODS

Design: Retrospective monitoring of HIV-1 concentration in longitudinal WW samples 02/2021–04/2023 from sewershed catchment areas (red) within San Francisco and Santa Clara counties (orange) in California, USA



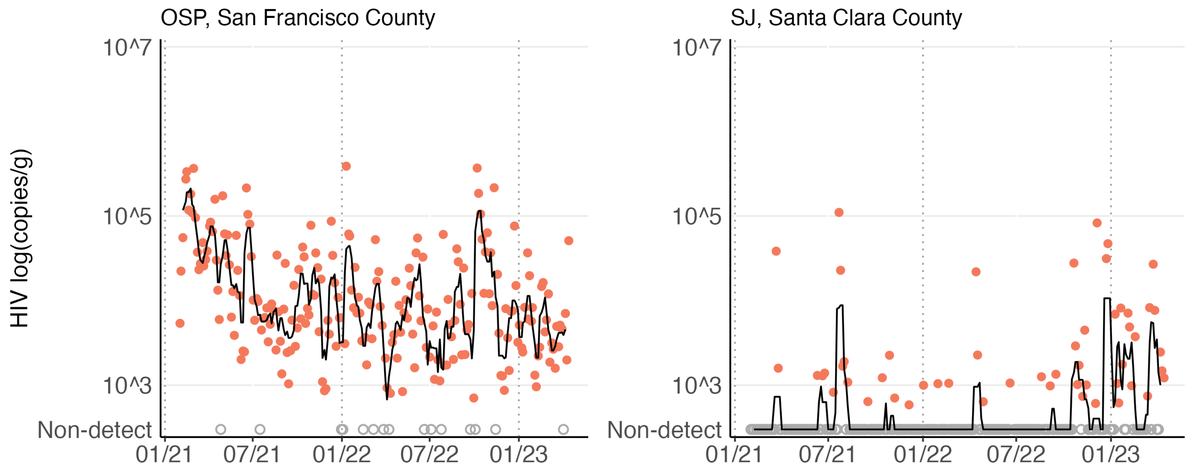
Measurements: Quantification of HIV-1 nucleic acids (NA) in wastewater settled solids using droplet digital RT-PCR with a hydrolysis-probe based PCR assay targeting the LTR region of HIV-1

Analysis: Trends in WW HIV-1 concentrations and comparison with HIV surveillance data from local health departments




## Monitoring HIV-1 nucleic acids in communal wastewater is feasible and is consistent with local surveillance data

**Figure 1. HIV-1 NA concentrations in wastewater across the study period.**

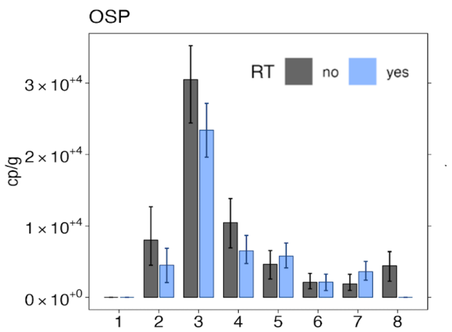



Y-axis shows log-transformed concentrations. Grey open circles show when HIV-1 was not detected. The solid line represents the 5-sample smoothed and trimmed average.

**Table 1. County HIV surveillance estimates in 2021-22**

| | San Francisco County | | Santa Clara County | |
|---|---|---|---|---|
| | 2021 | 2022 | 2021 | 2022 |
| Total people with HIV, N | 11830 | 11798 | 3618 | 3770 |
| People with HIV per 100k | 1405.5 | 1399.4 | 190.4 | 198.1 |
| New diagnoses, N | 166 | 157 | 133 | 165 |
| New diagnoses per 100k | 19.7 | 18.6 | 7.0 | 8.7 |
| Viral suppression, % | 72 | 73 | 70 | 68 |

**Figure 2. HIV-1 with and without RT in PCR**




Additional measurements at the San Francisco site were performed on 8 consecutive days in July 2023

## RESULTS

- Highly abundant HIV-1 NA were detected in 94% (215/230) and 23% (53/229) of samples in OSP and SJ sewersheds, respectively (Figure 1).
- Samples from the OSP sewershed consistently yielded higher levels of HIV NA than samples from SJ (OSP median 7.3*10^3 cp/g [range non-detect to 3.9*10^5 cp/g], SJ median non-detect [range non-detect to 1.1*10^5 cp/g], Figure 1).
- WW concentrations mirrored trends in community HIV prevalence both between and within counties (Table 1).
- PCR analyses comparing levels of HIV-1 NA with and without RT showed evidence of replicating virus on at least 2 days (Figure 2).

## CONCLUSIONS

- Results from WW can provide information on HIV at a local, community level and could help pinpoint communities needing enhanced surveillance.
- Further work is required to investigate dynamics of viral shedding in people with HIV, develop assays for antiretroviral drug-resistance in WW, and identify the optimal uses of WW surveillance of HIV-1.

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