The Role of Wastewater Data in Pandemic Management

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Key findings

A survey of 12 state and 194 local public health agency leaders about the role of wastewater data in pandemic management revealed the following:

Capacity and supports

/ In all, 92% of state and 38% of local agencies surveyed had monitored wastewater for SARS-CoV-2 at some point during the pandemic, for an average duration of nearly one year.

/ Partnerships with a local lab and utility and having buy-in from state or local government were the most common factors contributing to the success of wastewater surveillance programs.

/ Wastewater surveillance activities were predominantly funded through COVID-19 relief funds; National Wastewater Surveillance System funds; and federal, state, or local government grants.

Barriers to implementation

/ Only 7% of local agencies that had not monitored wastewater have what they need to begin doing so.

/ Lack of internal staff capacity was the most common barrier to implementing wastewater surveillance.

/ More rural than non-rural agencies reported barriers to implementation.

Value of the data

/ Wastewater data influenced pandemic management for roughly half of agencies with surveillance in place, informing decisions to coordinate response with other agencies, tailor communications to the public, and target clinical testing.

/ Agencies that monitored wastewater rated the data as only moderately useful and least influential among factors that inform pandemic management.

/ Many local agencies (38% rural and 26% non-rural) based decisions about pandemic restrictions on federal, state, or local guidance, and 42% of state agencies surveyed said they lacked or had limited authority to implement stricter pandemic response measures.

Future interest

/ In all, 66% of state and 21% of local agencies are likely to monitor their wastewater after the pandemic wanes.

/ State and local agencies were most interested in monitoring new pathogenic viruses or bacteria, influenza virus, substance use, and chronic disease markers in wastewater.

/ Most agencies that monitored wastewater were willing to share their wastewater data publicly.

/ Few agencies (25% of state and 6% of local agencies) expressed concerns around the ethical use of testing wastewater for public health surveillance.

Since the COVID-19 pandemic began, hundreds of communities have begun monitoring their wastewater for the SARS-CoV-2 virus. Wastewater surveillance offers unique advantages over traditional disease surveillance. Because the data are inherently collected at a community level, they provide broad population coverage in a cost-effective manner (Keshaviah et al. 2021), with one sample representing the infections of hundreds, thousands, or even millions of residents (EPA 2016). Further, wastewater monitoring can capture asymptomatic infections and does not require people to have the means or will to get tested, yielding a more objective measure of COVID-19 levels in a community than case counts. Many communities have also found that wastewater surveillance provides an early warning for new outbreaks (CDC 2022).

In response to the groundswell of interest in this complementary surveillance approach, the Centers for Disease Control and Prevention

(CDC) formed the National Wastewater Surveillance System in September 2020. The CDC is piloting the system with public health departments in 43 jurisdictions that are at different stages of implementation, and the number is growing (Kirby et al. 2021). The CDC funds and coordinates the collection and reporting of wastewater data, provides technical assistance to support implementation, and assembles Communities of Practice to help health agencies, utilities, and laboratories share best practices and lessons learned.

Despite the rapid growth in wastewater monitoring over the past two years, some public health agencies still lack the capacity to do so, and others struggle with how to interpret and use the data for pandemic management. To better understand the barriers and catalysts to implementing wastewater monitoring programs, Mathematica and The Rockefeller Foundation developed a survey to assess the role of wastewater data in pandemic management. By assessing which types of agencies have or lack access to wastewater data, and why they do or do not, we seek to advance the potential of wastewater surveillance to inform pandemic management in an equitable manner.

We surveyed state, local, territorial, and tribal public health officials who lead or support pandemic management decision making at their agency. The survey included questions related to five domains:

1/ factors influencing pandemic management decisions and actions;

2/ the landscape of wastewater surveillance in respondents' jurisdictions;

3/ barriers, supports, and capacity for wastewater surveillance;

4/ awareness and value of wastewater data; and

5/ future interest in wastewater monitoring for public health. Here, we describe findings around these five domains, how they varied by state versus local public health agencies, and any notable differences between local agencies serving rural versus non-rural populations.

A representative sample of public health agencies across the United States

After a nine-week fielding period (November 17, 2021, to January 20, 2022), we received responses from 194 local public health agency officials (74% of whom lead pandemic management decision making, with the rest playing a supportive role) and 12 state public health agency officials (33% of whom lead pandemic management decision making). The survey captured information from public health
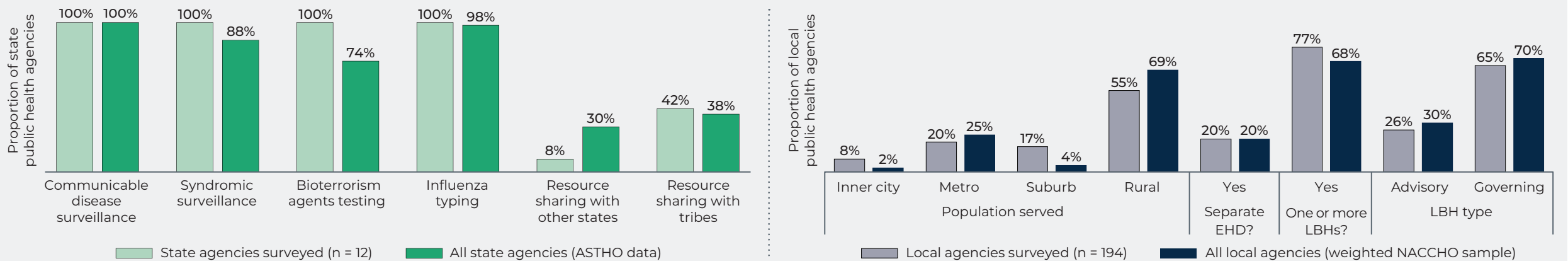

Exhibit 1. States represented by surveyed agencies

- 15-40
- 6-14
- 1-5
- 0

Number of responses
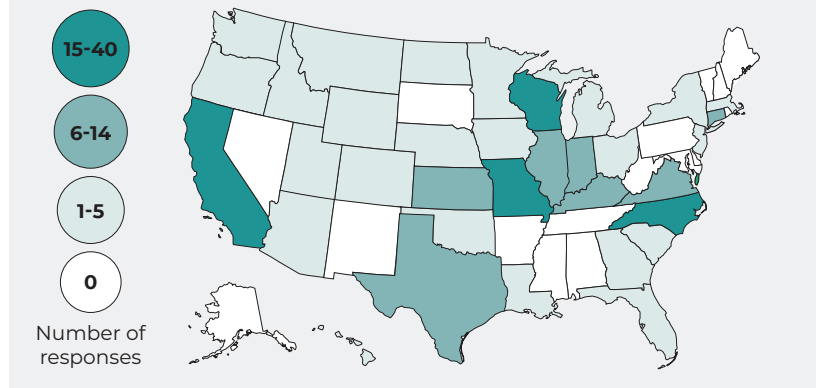
agencies across the 34 states (68%; Exhibit 1), representing 101 U.S. counties (3%) and one tribal nation (<1%). Just over half of the local agencies (55%) serve rural populations.

With respect to organizational features that might influence the feasibility of implementing wastewater monitoring, characteristics of the surveyed agencies generally aligned with those of all public health agencies across the country, based on comparisons between the state

Exhibit 2. Characteristics of state and local public health agencies surveyed

Proportion of state public health agencies

Characteristic	State agencies surveyed (n = 12)	All state agencies (ASTHO data)
Communicable disease surveillance	100%	100%
Syndromic surveillance	100%	88%
Bioterrorism agents testing	100%	74%
Influenza typing	100%	98%
Resource sharing with other states	8%	30%
Resource sharing with tribes	42%	38%

Proportion of local public health agencies

	Local agencies surveyed (n = 194)	All local agencies (weighted NACCHO sample)
Inner city	8%	2%
Metro	20%	25%
Suburb	17%	4%
Rural	55%	69%
Yes Separate EHD?	20%	20%
Yes One or more LBHs?	77%	68%
Advisory (LBH type)	26%	30%
Governing (LBH type)	65%	70%

ASTHO = Association of State and Territorial Health Officials; EHD = environmental health department; LBH = local board of health; NACCHO = National Association of County and City Health Officials.

[1] Of the 12 state public health agencies surveyed, 7 are home rule states, in which the state's constitution grants municipalities and/or counties the ability to pass laws to govern themselves as they see fit, and another 4 states grant limited authority to local governments to govern themselve.

agencies sampled and 2019 data from the Association of State and Territorial Health Officials, and between the local agencies sampled and 2019 data from the National Association of County and City Health Officials' National Profile of Local Health Departments (Exhibit 2). Our sample of local agencies might have slightly underrepresented agencies serving rural populations and slightly overrepresented those serving suburban populations. The sample might have also slightly overrepresented agencies with one or more local boards of health, though it's also possible that the number of agencies with a local board of health increased since 2019.

Factors influencing pandemic management

Data play a central role in pandemic management. Virtually all the agencies surveyed reported that they review data daily or weekly to

Exhibit 3. Factors influencing pandemic management

Factor	Average rating (out of 5)	
	State agencies	Local agencies
Data on transmission	★★★★★ 4.8	★★★★★ 4.7
State or national guidance or policies	N/A	★★★★★ 4.7
Information or feedback from local officials	★★★★☆ 4.1	N/A
Economic impact on community	★★★★☆ 4.1	★★★★☆ 3.9
State or national political considerations	★★★★☆ 4.1	★★★☆☆ 3.2
Community sentiment / tolerance	★★★★☆ 3.7	★★★★☆ 3.6
Environmental data	★★★☆☆ 3.2	★★★☆☆ 3.2

Scale: 1 = not influential, 3 = somewhat influential, 5 = very influential; N/A = not asked.
Other factors specified were local political considerations, community resources, and equity.

inform pandemic management decisions. Traditional surveillance data (on clinical cases, deaths, test positivity, hospitalizations, and health system capacity) were reviewed by 95% to 100% of state and local officials. The use of nontraditional data sources was less common: 75% of state agencies and 55% of local agencies surveyed review environmental data (such as from air, wastewater, or surface monitoring), and 17% of state and 48% of local agencies (54% rural and 40% non-rural) review data on COVID-19-like symptoms (a proxy for infections).

The relative influence of different data sources was largely consistent across state and local officials (Exhibit 3). Data on COVID-19 transmission ranked very influential, as did state or national guidance or policies (for local agencies) or information or feedback from local agencies (for state agencies). The economic impact of decisions ranked moderately influential, followed by community sentiment or tolerance for mitigation measures. Political considerations were more influential among state agencies (with an average rank of 4.1 out of 5) than local agencies (with an average rank of 3.2). **Environmental data were only somewhat influential and ranked lower than all other factors.**

When asked in an open-ended fashion how officials decide when to implement stricter pandemic response measures, 42% of state and 13% of local agencies said they lacked or had limited authority to do so (with most states indicating that such authority rested with the governor). To inform their decisions or recommendations on when to implement stricter response measures, agencies considered a combination of data on disease transmission, deaths, and hospitalizations (58% of state and 45% of local agencies), information on health care capacity (25% of state and 6% of local), and community receptivity (8% of state and 5% of local). One-third of local agencies (38% rural and 26% non-rural) based such decisions on guidance from federal, state, or local officials.

State and local officials indicated the need for better data around additional dimensions. One-third of state officials wanted more data on health behaviors (such as adherence to masking and social distancing recommendations), 17% of state and 11% of local officials wanted wastewater data (including wastewater monitoring of viral variants) or better wastewater-based metrics, and less than 10% of state and local agency leaders said that having hospitalization data, data on vaccinations and breakthrough infections, sequencing data, data on demographic subpopulations, and more localized data would be helpful for pandemic management.

Current landscape of wastewater surveillance

Of the 12 state agencies surveyed, 11 (92%) were actively coordinating wastewater surveillance (with 6 participating in the National Wastewater Surveillance System), and 38% of local agencies (30% rural and 47% non-rural) had monitored wastewater for SARS-CoV-2 at some point during the pandemic, with 30% still doing so. On average, these agencies had monitored wastewater for almost one year.

Agencies collected wastewater samples from several types of locations, including central wastewater treatment plants (100% of state and 71% of local agencies), neighborhoods (36% of state and 27% of local agencies; among local agencies, 19% of rural and 34% of non-rural agencies collected from neighborhoods), and prisons or jails (36% of state and 5% of local agencies). Less than 20% of state and local agencies were monitoring colleges or universities, K–12 schools, or congregate care facilities, though monitoring at these sites was more commonly done by non-rural local agencies than rural agencies.

Wastewater surveillance activities were predominately funded through COVID-19 relief funds (55% of state and 26% of local agencies), National Wastewater Surveillance System funds (45% of state and 16% of local agencies), state or local government grants (18% of state and 38% of local agencies), other federal government grants (27% of state and 10% of local agencies), and, to a lesser extent, foundation funding (0% of state and 5% of local agencies).

Barriers, supports, and capacity for wastewater surveillance

Among state and local agencies, lack of internal capacity was the most common barrier cited to implementing wastewater surveillance, and partnerships and government buy-in were the most common factors that contributed to the success of wastewater surveillance programs (Exhibit 4).

Most state agency leaders reported that supports for wastewater surveillance—including funding, buy-in, partnerships, and staff capacity—were fully or somewhat in place (Exhibit 5). By contrast, most local agency leaders lacked these supports or were unsure of whether they had them in place. **Among local agencies, those serving**

Exhibit 4. Barriers and supports to wastewater surveillance programs

Barriers to implementation

✗ **Competing priorities or a lack of capacity** (72% of state, 47% of local agencies)

✗ **No clear agency responsible for leading this work** (18% of state, 25% of local agencies)

✗ **Lack of funding** (0% of state, 27% of local agencies)

✗ **Lack of buy-in from community leaders** (0% of state, 22% of local agencies)

✗ **Lack of partnership with a wastewater lab or utility** (9% of state, 14% of local agencies)

✗ **Other** (comments described a lack of funding, lack of political will, and shoddy lab work)

Factors contributing to success

✓ **Partnership with a local lab or utility** (91% of state, 61% of local agencies)

✓ **Buy-in from state or local government** (82% of state, 60% of local [47% rural, 72% non-rural] agencies)

✓ **Sufficient funding** (82% of state, 44% of local agencies)

✓ **Engagement with the local community** (45% of state, 29% of local agencies)

Exhibit 5. Extent to which agencies have capacity for wastewater surveillance

State agencies — Fully in place | Somewhat in place | Not in place | Not sure

	Fully	Somewhat	Not in place	Not sure
Funding to support implementation	83%		8%	8%
Funding to support tailored action	25%	42%	25%	8%
Buy-in from community	25%	58%	8%	8%
Working relationship with utility	83%	17%		
Working relationship with lab	75%	25%		
Timely reporting from lab	67%	25%	8%	
Staff capacity to interpret or communicate data	42%	42%	17%	

Local agencies — Fully in place | Somewhat in place | Not in place | Not sure

	Fully	Somewhat	Not in place	Not sure
Funding to support implementation	9%	21%	55%	16%
Funding to support tailored action	9%	23%	57%	13%
Buy-in from community	12%	34%	35%	18%
Working relationship with utility	27%	31%	32%	10%
Working relationship with lab	31%	19%	39%	11%
Timely reporting from lab	29%	19%	37%	16%
Staff capacity to interpret or communicate data	24%	32%	35%	9%

Note: We asked these questions only if agencies had some familiarity with wastewater surveillance. As a result, the bottom panel excludes 17% of local agencies (12 with no familiarity with wastewater surveillance, and another 21 that skipped these questions).
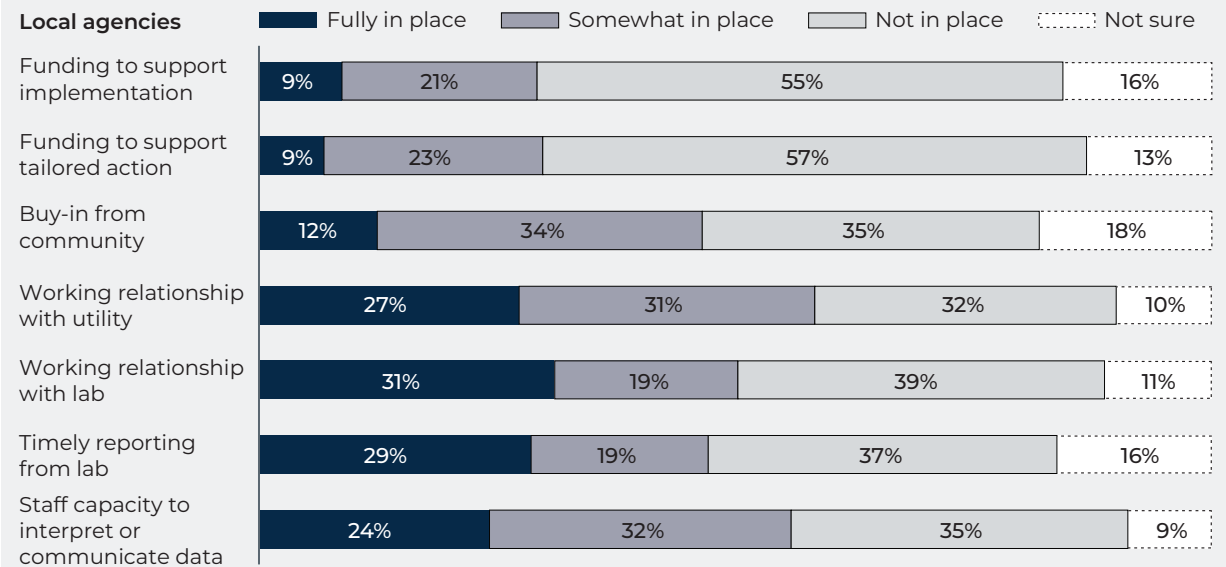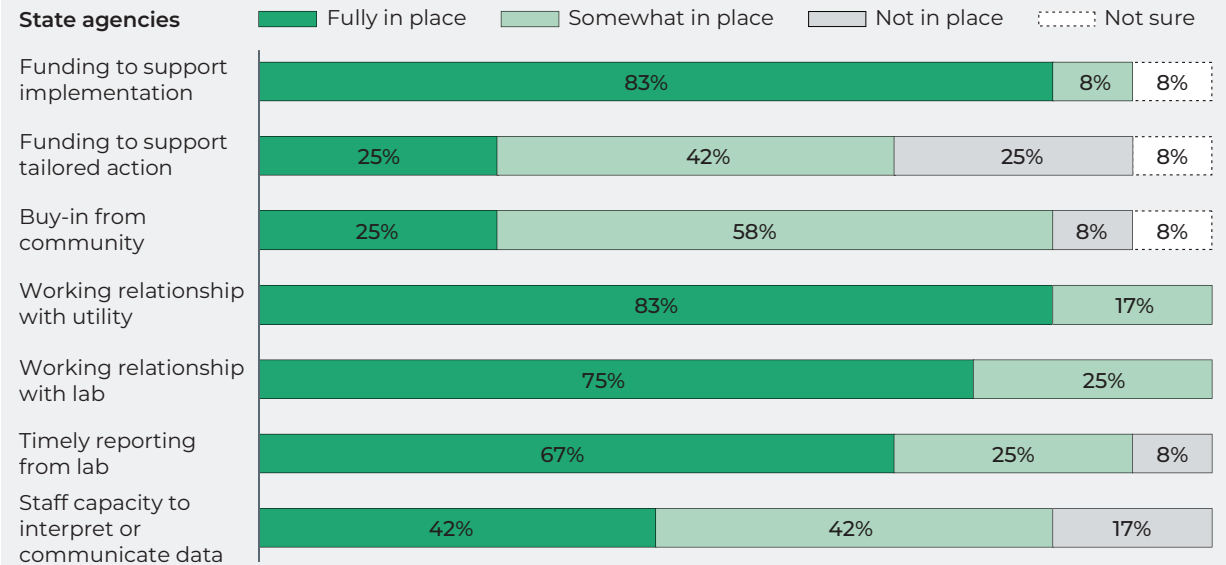
rural communities reported more barriers to wastewater surveillance that those serving non-rural communities, including lacking a relationship with the utility (39% versus 24%, respectively), a relationship with a wastewater testing lab (48% versus 28%), timely reporting of data from the lab (45% versus 28%), and internal staff capacity for wastewater surveillance (42% versus 28%).

The most common factors that motivated agencies to implement wastewater surveillance were expert advocates within or affiliated with the agencies surveyed (73% of state and 40% of local agencies) and the availability of COVID-19 relief or other start-up funds (73% of state and 30% of local agencies). Momentum created by the National Wastewater Surveillance System also played a role for roughly one-third of state and local agencies surveyed. Inadequate clinical testing was a factor for only 22% of local agencies (but no state agencies), and coordination by the state public health agency played a role in motivating 14% of local agencies

to implement wastewater surveillance. Expert advocates played a larger role in motivating non-rural local agencies (49%) than rural ones (28%), and commercial partners played a larger role among rural (25%) than non-rural (7%) local agencies.
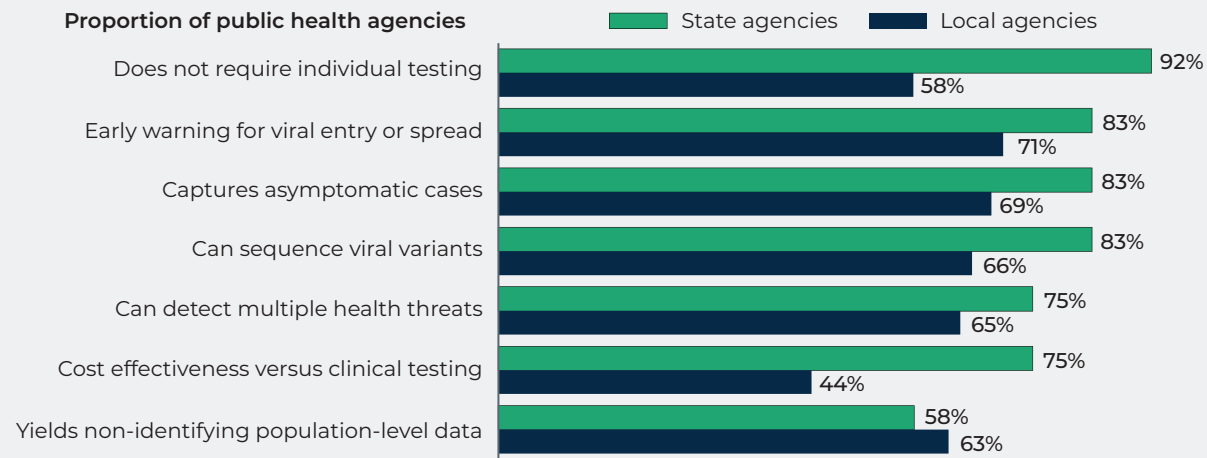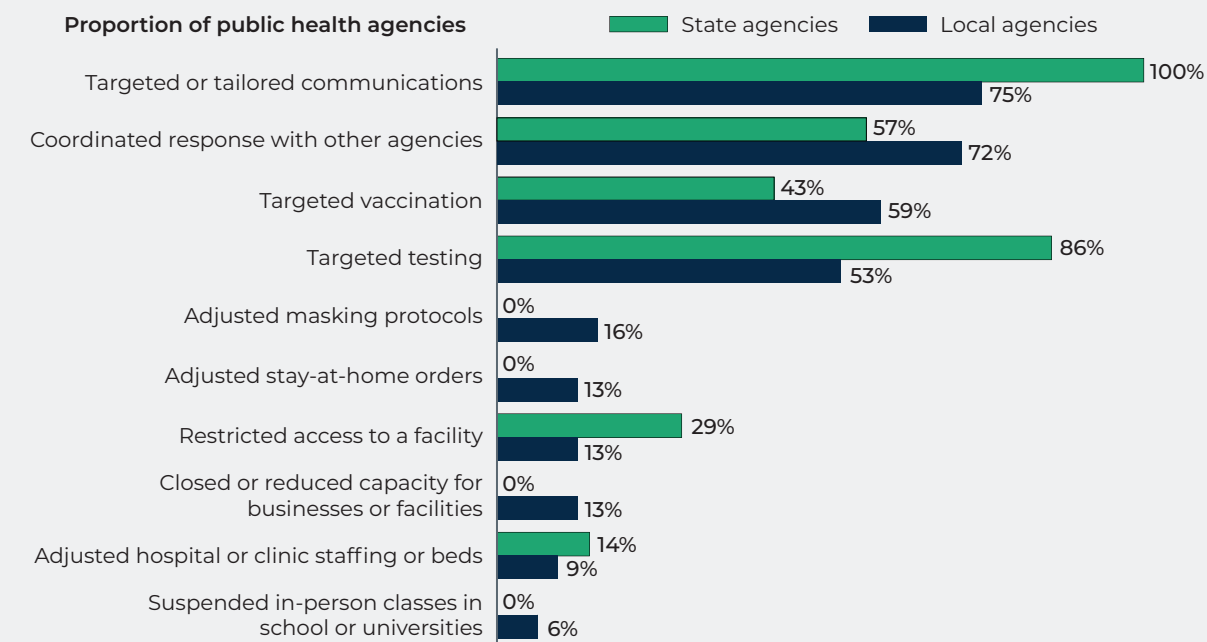
One state agency surveyed (8%) had not coordinated or led wastewater surveillance in the state, citing a lack of internal capacity for this work. This agency also said it did not have what it needed to begin. Among the local agencies surveyed, 58% had not implemented wastewater surveillance at any point during the pandemic, and only 7% said they had what they needed to begin (38% were unsure, and 50% said they did not have what they needed). The top reasons cited for not conducting wastewater surveillance included lack of internal capacity (58%), lack of a wastewater testing lab nearby (29%; 33% of rural and 14% of non-rural reported the lack of a nearby lab), and lack of a connection to the local utility (26%; 37% of rural and 16% of non-rural agencies reported the lack connection to a local utility). Another 21%

Exhibit 6. Valuable aspects of wastewater data

Proportion of public health agencies

■ State agencies ■ Local agencies

	State	Local
Does not require individual testing	92%	58%
Early warning for viral entry or spread	83%	71%
Captures asymptomatic cases	83%	69%
Can sequence viral variants	83%	66%
Can detect multiple health threats	75%	65%
Cost effectiveness versus clinical testing	75%	44%
Yields non-identifying population-level data	58%	63%

Note: We asked these questions only if agencies had some familiarity with wastewater surveillance.

Exhibit 7. Pandemic management decisions or actions influenced by wastewater data

Proportion of public health agencies

■ State agencies ■ Local agencies

	State	Local
Targeted or tailored communications	100%	75%
Coordinated response with other agencies	57%	72%
Targeted vaccination	43%	59%
Targeted testing	86%	53%
Adjusted masking protocols	0%	16%
Adjusted stay-at-home orders	0%	13%
Restricted access to a facility	29%	13%
Closed or reduced capacity for businesses or facilities	0%	13%
Adjusted hospital or clinic staffing or beds	14%	9%
Suspended in-person classes in school or universities	0%	6%

of these agencies said they did not understand how to interpret wastewater data, and 17% said that the wastewater data did not add value or that other data or information fully met their needs or that. Only 3% of local agencies cited a lack of trust in wastewater data as the reason for not implementing surveillance, and 3% cited a lack of funding.

Awareness and value of wastewater data

Familiarity with wastewater data was high among agencies that had implemented wastewater surveillance. All state agency leaders had some familiarity with the approach (with 92% moderately or extremely familiar), as did 87% of local agency leaders (with 47% moderately or extremely familiar).

Among those with at least some familiarity, many recognized the particular advantages of wastewater data over clinical surveillance data. State officials almost unanimously valued the broad population coverage and lack of individual testing required with wastewater surveillance, but they placed less value on the non-identifying nature of the data (Exhibit 6). Roughly 60% to 70% of local agencies surveyed found most features of wastewater data to be valuable except for cost effectiveness of the wastewater data, which as valued least (by 44% of local agencies). Fewer rural agencies valued the broad population coverage that wastewater data provide than their non-rural counterparts did (61% versus 70%, respectively), and more rural agencies valued that the data did not require individual testing (62% versus 54%). Other valuable aspects of wastewater data (specified in comments) included surveillance of populations that are unlikely to be reflected in clinical case data (such as tourists), the ability to detect viral variants, and filling gaps in clinical data once at-home testing increases.

In line with the rating of environmental data as only moderately influential, agencies that had

implemented wastewater surveillance generally found it to be only moderately useful to inform their pandemic management. The average rating these agencies gave on a scale of 1 to 5 (with 1 = not at all useful, 3 = somewhat useful, and 5 = very useful) was 3.3 among state and 3.5 among local officials. In all, 27% of state officials and 22% of local officials found wastewater data to be very useful, and only 18% of state officials and 4% of local officials found it to be not at all useful.

Wastewater data had influenced the pandemic management of roughly half of the agencies that had implemented wastewater surveillance (64% of state and 44% of local agencies). State agencies were most likely to use wastewater data to target or tailor communications to the public and to target clinical testing, and local agencies were most likely to target or tailor communications to the public and to coordinate response with other agencies or departments (Exhibit 7). More rural than non-rural local agencies used wastewater data to target or tailor communications (83% versus 70%, respectively), coordinate response (83% versus 65%), and target vaccine efforts (75% versus 50%).

Among the agencies that had not acted on the wastewater data, reasons cited included that pandemic management decisions or actions are based on other data or other factors, that wastewater data are not timely or localized enough, that they did not know how to compare or integrate wastewater data with other data, and that they did not understand the wastewater data. More non-rural than rural agencies reported that wastewater data were not localized enough (39% versus 20%, respectively), and more rural than non-rural agencies reported that they did not understand the wastewater data (13% versus 0%). In open-ended comments, several local agency leaders expressed frustration at not receiving any communication from their partners (state health department, local lab, or university researchers) doing the testing.

Future interest in wastewater surveillance

Looking to the future, 66% of state and 21% of local agencies reported being likely or extremely likely to conduct wastewater surveillance after the pandemic wanes, and 40% of local agencies reported neutral interest. Agencies with wastewater surveillance already in place were more likely than those without it to express interest in conducting wastewater surveillance in the future (36% versus 13%, respectively). The public health targets of greatest interest to monitor in wastewater included new pathogenic viruses or bacteria, substance use, and chronic diseases (Exhibit 8). More non-rural than rural local agencies were interested in monitoring antibiotic resistance (44% versus 22%, respectively).

Among the agencies with wastewater surveillance in place, most (64% of state, 49% of local agencies) were willing to share their wastewater data publicly. Strikingly, most of those who said they were not willing to share the data commented that they did not have or own the data. In other words, beyond not receiving communications about results, many local public health agency leaders also are not receiving the wastewater data being collected. Only 25% of state agencies and 6% of local agencies expressed concern about the ethical use of testing wastewater for public health surveillance. These agencies described possible ethical issues arising due to confidentiality when disclosing data collected on small populations, community stigmatization, data limitations in rural areas, and collecting but not knowing how to act on the wastewater data (without knowing who in a community is infected or which areas have higher transmission rates).

Implications of survey findings

This survey of public health agencies captured the experiences of a diverse set of state and local public health agencies across the country. Findings confirm that officials recognize the unique, complementary value that wastewater data can provide and that they routinely review wastewater data alongside traditional surveillance data to inform pandemic management. Many agencies that monitor wastewater have used the data in tangible ways to target or tailor pandemic response.

The survey also revealed that several challenges remain in implementation. Public health agencies must expand their internal

Exhibit 8. Types of wastewater data of greatest interest

- New pathogenic viruses or bacteria: 66%
- Influenza virus: 46%
- Substance use: 37%
- Chronic diseases: 33%
- Antibiotic resistance: 33%
- Stress, tobacco, or alcohol use: 13%
- Human biomarkers: 8%
- Gut microbiome: 3%
- Other: 4%

Other targets of interest:
/ Ongoing monitoring of COVID-19
/ Sexually transmitted diseases
/ Gastrointestinal viruses
/ Uncommon diseases such as polio
/ Animal feces in runoff

capacity and ensure that funding is sustained and distributed to support data collection and data-driven action. Forming partnerships across agencies can be a difficult hurdle to surmount but is critical to supporting wastewater surveillance. When partners come together and collaborate, they fortify their communities' public health infrastructure by lending their diverse perspectives, contributing human and financial capital, and fostering the engagement of the community groups they represent. That fewer rural communities have relationships with a local wastewater lab, utility, or expert advocates suggests potential disparities in feasibility that could lead to non-representative data collection if these barriers remain unaddressed.

With respect to data reporting, the agency leaders surveyed largely supported public disclosure of wastewater data, in line with findings from a community survey that gauged public attitudes toward wastewater data sharing (Holm et al. 2021). Yet improvements are required to make the data and findings more accessible because public health officials do not always easily understand technical wastewater reports and metrics. The state and local agencies we surveyed reported that wastewater data are only moderately useful and are least influential to their pandemic management. To boost wastewater analytics, The Rockefeller Foundation and Mathematica are developing a wastewater-informed risk tool for public health agencies. Insights from this survey will serve to tailor the tool so that it provides useful metrics and interpretation for pandemic management.

With respect to future interest in wastewater surveillance, most state agencies and a sizeable minority of local agencies surveyed are likely to continue or initiate wastewater monitoring for public health after the pandemic wanes. It's worth noting that our survey largely captured the interest and attitudes of public health agencies toward wastewater testing before the surge of the Omicron variant of SARS-CoV-2. Since then, interest in wastewater surveillance has increased, particularly after reports indicating that some cities detected the Omicron variant in the wastewater days before the first confirmed clinical case (Adegbesan 2022).

Conclusion

Wastewater monitoring for public health is at a pivotal moment in the United States. Because it can measure a wide range of health issues—from chronic diseases to substance use—public health officials would do well to use the momentum created by the COVID-19 pandemic to bolster their infrastructure for wastewater surveillance. For wastewater monitoring to serve as an effective public health tool in the future, labs must improve data sharing and timeliness, researchers and officials must better integrate and communicate wastewater data to characterize community risk, and funding and opportunities must be created to ensure that all communities have an equal opportunity to benefit from this innovative approach to monitor population health.

References

Adegbesan, Angel. "Omicron's Spread Through U.S. Cities Is Shown in Wastewater Study." *Bloomberg*, January 20, 2022. Available at https://www.bloomberg.com/news/articles/2022-01-20/omicron-s-spread-through-u-s-cities-shown-in-wastewater-study. Accessed April 1, 2022.

Centers for Disease Control and Prevention (CDC). "National Wastewater Surveillance System (NWSS) – Wastewater Surveillance Can Provide an Early Warning of COVID-19's Spread in Communities." 2022. Available at https://www.cdc.gov/healthywater/surveillance/wastewater-surveillance/wastewater-surveillance.html#early-warning. Accessed April 1, 2022.

Holm, R.H., J.M. Brick, A.R. Amraotkar, J.L. Hart, A. Mukherjee, J. Zeigler, A.M. Bushau-Sprinkle, et al. "Public Awareness and Support for Use of Wastewater for SARS-CoV-2 Monitoring: A Community Survey in Louisville, Kentucky." medRxiv, 2021. Available at https://doi.org/10.1101/2021.10.19.21264954. Accessed April 1, 2022.

Keshaviah, A., X.C. Hu, and M. Henry. "Developing a Flexible National Wastewater Surveillance System for COVID-19 and Beyond." *Environmental Health Perspectives*, vol, 129, no. 4, 2021.

Kirby, A., M.S. Walters, W.C. Jennings, R. Fugitt, N. LaCross, M. Mattioli, Z.A. Marsh, et al. "Using Wastewater Surveillance Data to Support the COVID-19 Response — United States, 2020–2021." *Morbidity and Mortality Weekly Report*, vol. 70, no. 36, 2021, pp. 1242–1244.

Environmental Protection Agency (EPA). "Clean Watersheds Needs Survey 2012." 2016. Available at https://www.epa.gov/cwns. Accessed April 1, 2022.

Survey methods

In the third quarter of 2021, The Rockefeller Foundation and Mathematica developed an online survey of public health agency leaders to assess the role of wastewater data in their pandemic management activities. The survey included roughly 50 questions (with a 10- to 15-minute administration time) programmed into SurveyMonkey. We customized the language for state versus local agencies because each plays a slightly different role in wastewater monitoring. We piloted the survey with a state agency official, local agency official, and university wastewater researcher.

Fielding of the survey was based on a convenience sample. To develop a survey dissemination list, we first used publicly available data sources to identify contacts for health leaders in all 50 states and in 325 cities with 50,000 residents or more. (If the city did not have its own health department, we included the county health department in our list.) To broaden the sample, we searched state websites for online contact lists that included all local public health departments in the state (including in rural counties), and we successfully obtained lists for 17 states. We also included state epidemiologists identified through a contact list from the Council of State and Territorial Epidemiologists. Lastly, we reached out to state and local public health agency contacts in the professional networks of Mathematica and The Rockefeller Foundation.

The online survey was active for nine weeks (November 17, 2021, to January 20, 2022). During this time, we sent four email reminders and offered a $25 electronic gift card incentive to the first 100 local survey respondents and first 25 state survey respondents. In our outreach efforts, we stressed the value of hearing from communities with and without wastewater surveillance in place.

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