Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Wastewater surveillance: an effective and adaptable surveillance tool in settings with a low prevalence of COVID-19

As Christopher McMahan and colleagues note in their Article,[1] wastewater surveillance of SARS-CoV-2 fills an important surveillance gap left by incomplete individual testing. Everyone defecates but not everyone gets tested for SARS-CoV-2. The key purpose of surveillance is to provide data for informed policy making. We commend the authors for addressing the difficult question of how to establish a quantitative value for a community's viral load in a setting with a high prevalence of COVID-19, and then for proposing a method for communicating results to policy makers and the public.

Most literature reporting wastewater surveillance discusses its application in settings with a high prevalence of COVID-19—particularly to track trends and identify hotspots—and McMahan and colleagues[1] add to this literature. However, in a setting with a low prevalence of COVID-19, such as Australia experienced for much of the first 21 months during the pandemic, wastewater surveillance of SARS-CoV-2 unexpectedly became a core epidemiological indicator supporting policy making, with the Australian Government Department of Health working with states and territories to coordinate wastewater testing efforts. Throughout 2020 until September, 2021, Australia's pandemic response focused on aggressive suppression of community transmission, with a requirement to rapidly detect all SARS-CoV-2 infections and to ensure no unrecognised chains of transmission in the community.

Wastewater surveillance of SARS-CoV-2 was used to systematically detect viral RNA fragments in wastewater, primarily as an early warning system of local viral introduction and transmission (table 1). This action was designed to complement other forms of surveillance, particularly individual testing, informing targeted action for public health, including enhanced capacity for individual testing and public health messaging following local detections.

The benefits of wastewater surveillance are found in its simplicity, which allows for community-wide screening without any behavioural changes from the general population (table 1). Therefore, the biases seen with clinical testing are minimised—ie, everyone uses the toilet and shower but not everyone gets tested. Additionally, wastewater surveillance assists with epidemiological investigation, helping to identify at-risk locations visited by individuals who test positive for SARS-CoV-2 and providing a pooled population sample to establish the presence or absence of SARS-CoV-2

	Early wastewater surveillance phase	Established wastewater surveillance phase
Timeframe	January to May, 2021	June to September, 2021
Australian context	National suppression strategy; limited or targeted access to vaccines; quarantine and isolation; testing and contact tracing; lockdowns and border controls	National four-point response plan moving from current suppression strategy to a post-vaccination phase, focused on prevention of severe outcomes; progressive vaccination of eligible population; quarantine and isolation; testing and contact tracing; progressive restrictions, lockdowns, and border controls
COVID-19 situation	Few and limited outbreaks; small numbers of positive cases; limited transmission; limited cross-border incursions; most outbreaks linked to overseas arrivals	Presence of delta (B.1.617.2) variant; less controlled outbreaks; multiple outbreaks within states; cross-border incursions; multiple states affected; most outbreaks linked to domestic cases; more unexplained cases in previously unaffected areas; New South Wales cases peaked at >800 cases per day
Surveillance strategy	Early and initial implementation and trialling in jurisdictions; non-standardised approaches across jurisdictions; no national reporting; development of protocols from environmental health and wastewater authorities; supplemented traditional surveillance systems; sophistication of systems varied widely across jurisdictions; catchments primarily in urban settings, with some regional catchments	Implementation in all jurisdictions; development of wastewater surveillance protocols (including interpretation, investigation, and public health action); discussion of national standards and reporting; adaptive surveillance system supplementing traditional surveillance systems
Issues	Limited understanding of sensitivity and specificity of wastewater surveillance; difficulty interpreting viral loads; scarce evidence supporting that early detection through wastewater surveillance helped to identify positive cases	Frequency and timeliness of sampling and results
Benefits	Community-wide screening without any behavioural changes required from the general population; pooled population sample to establish the presence or absence of SARS-CoV-2 in a defined community; reduced biases seen with clinical testing	Community-wide screening without any behavioural changes required from the general population; pooled population sample to establish the presence or absence of SARS-CoV-2 in a defined community; reduced biases seen with clinical testing; adaptive surveillance system could rapidly sample targeted populations; provided added confidence for policy decisions; showed geographical spread and community burden of the virus

Table 1: **Phases of SARS-CoV-2 wastewater surveillance in Australia from January to September, 2021**

	Early wastewater surveillance phase		Established wastewater surveillance phase	
	Policy implications	Public health action	Policy implications	Public health action
Local level	Early warning system	Continuation of existing public health strategies; supplementary confirmation of presence or absence of positive cases; targeted public health messaging encouraging symptomatic people to get tested	Highlights new areas of concern; detects viral shedding after release from isolation; identifies multiple chains of infection and proves cessation of local transmission; allows for epidemiological investigation to identify at-risk locations	Targets public health messaging; supplementary confirmation of presence or absence of positive cases; identifies at-risk locations; targeted public health messaging encourages symptomatic people to get tested
State level	Epidemiological assessment; supplementary confirmation of presence or absence of positive cases in communities, regions, and states	Targeted messaging and testing (new testing sites and laboratory surge); implementation or lifting of lockdowns	Leading indicator; indicates geographical spread of the virus; targets delivery of vaccines	Targeted messaging and testing (new testing sites and laboratory surge); restriction of travel to regional or remote communities; implementation or lifting of lockdowns
National level	Contributes to epidemiological and risk assessments	Adapting national responses	Contributes to epidemiological and risk assessments	Adapted national responses, including vaccination strategy
Other jurisdictions	Contributes to daily risk assessments	Implementation of controlled border arrangements; identification of high-risk locations; response measures in high-risk areas	Contributes to daily risk assessments of possible incursions from other states; implementation of controlled border arrangements	Implementation of controlled border arrangements; response measures in high-risk areas

Policy implications and public health actions applicable to other settings with a low prevalence of COVID-19.

***Table 2*: Application of SARS-CoV-2 wastewater surveillance to policy making at different governmental levels in Australia**

in a community with a defined low prevalence. The importance of this surveillance strategy increased in 2021 when the delta (B.1.617.2) and omicron (B.1.1.529) variants disrupted Australia's previously successful public health response to the pandemic (table 2). The transmission of these variants proved to be far more difficult to control than the earlier ancestral and alpha (B.1.1.7) variants, and required adaptive surveillance systems to support decision making. Despite initial scepticism in Australia, this surveillance strategy has become embedded as a key component of the public health response in a setting with a low prevalence of COVID-19.

We declare no competing interests.

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1 McMahan C, Self S, Rennert L, et al. COVID-19 wastewater epidemiology: a model to estimate infected populations. *Lancet Planet Health* 2021; **5:** e874–81.