InFOCUS

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Identifying the Next Drug Epidemic by Testing Municipal Wastewater

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Opioid misuse continues to rise across the United States. One reason for the ongoing epidemic is the difficulty in obtaining real-time information on an ever-changing landscape of drug supply and demand. Many widely used data sources, such as national population surveys, have a two-year lag before the data are available, and they underestimate the prevalence of drug use because they rely on self-reported information about a stigmatized behavior. As a result, officials must operate reactively to shifts in drug diversion, abuse, and addiction. Moreover, experts are now warning of emerging surges in the use of stimulants like methamphetamines and cocaine. To address the breadth and complexity of substance abuse, a more comprehensive monitoring strategy is necessary—one that goes beyond siloed approaches focused on individual drugs or interventions. Municipal wastewater testing is an innovative approach that can augment existing data by providing more rapid, cost-effective, and unbiased measures of drug use.

ACTIONABLE INTELLIGENCE FOR PUBLIC SAFETY

Across Europe, Australia, and Asia, wastewater testing is being conducted using best practices developed by the Sewage Analysis CORe group Europe (SCORE). Over the years, SCORE members have validated wastewater-based estimates of drug use against population survey results, and their work led the European Monitoring Centre for Drugs and Drug Addiction to use wastewater testing as part of a holistic multi-indicator monitoring and alert system. The Australian Criminal Intelligence Commission also relies on wastewater testing to assess operational priorities. Data from the commission's National Wastewater Drug Monitoring Program serve to calculate what percentage of drugs consumed in the population were seized by its agents so as to gauge the effectiveness of law enforcement efforts.

A MULTI-INDICATOR SOURCE FOR PUBLIC HEALTH

Americans today face unprecedented exposure to deadly drugs such as fentanyl and carfentanil, viral outbreaks such as Zika and Ebola, and antibiotic-resistant bacterial strains such as Clostridium difficile and Methicillin-resistant Staphylococcus aureus. These evolving public health threats, coupled with existing epidemics, such as obesity and diabetes, provide one of the strongest arguments for wastewater testing, which can flexibly measure and monitor a range of compounds circulating through a population. Indeed, wastewater testing can shed light on multiple drugs of abuse simultaneously, because a single wastewater sample can be tested for up to two dozen compounds. The methodology is also relatively inexpensive, costing $100 to $150 per sample to test for a panel of drug markers.

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Ongoing wastewater studies are taking place in Massachusetts, North Carolina, Wisconsin, Washington, and other states to do the following:

- **Locate** geographic hotspots by analyzing how drug concentrations vary across a region
- **Provide** an early warning for substances entering into a community by measuring the presence in wastewater of a non-targeted panel of drugs of concern
- **Understand** exposure risks in the population by identifying the mix of drugs being used
- **Assess** program effectiveness by comparing drug concentrations before and after launch
- **Track** population health markers such as the flu virus, smoking, and obesity

WIDESPREAD COVERAGE

A particular advantage of wastewater monitoring is that it can be fairly comprehensive—centralized wastewater treatment facilities serve 81 percent of U.S. households. Yet it can also provide spatially granular data, because almost 40 percent of treatment facilities serve fewer than 1,000 people. Moreover, because most wastewater plants collect daily samples for monitoring, as mandated by the Clean Water Act, researchers can efficiently study temporal trends with existing sampling procedures. Although wastewater-based data cannot reveal who is using a particular drug (mitigating privacy concerns), the data can be paired with other sources to triangulate important features of drug use and identify hotspots to align resource allocation with population needs. When used in combination with geospatial mapping and advanced analytics, wastewater-based epidemiology has the potential to help officials predict rather than react to changes in drug use.
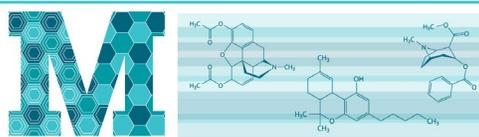
The Potential of Wastewater Testing for Public Health and Safety

LOOKING AHEAD

Estimating population drug use through wastewater testing is slowly gaining traction across the United States, but more pilot studies are needed to help explore the policy value of wastewater testing. Mathematica is working with researchers to understand the types of decisions that could be informed by a more rapid and geographically precise data source and to undertake a cost-benefit analysis of this innovative approach. Although the opioid epidemic continues to be the focus of attention, experts are now warning of new waves of addiction stemming from spikes in methamphetamines in the Pacific Northwest and cocaine in the Northeast. Given that addiction often involves use of more than one type of drug, it is essential that public safety and public health officials harness the rich, near real-time data available from wastewater testing to prevent the next drug epidemic.

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To learn more about wastewater testing, see Mathematica's research brief and special report.

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