# Innovative Methods to Improve the Measurement, Treatment, and Prevention of Opioid Misuse

Each year, the opioid epidemic costs the United States tens of billions of dollars in health care costs, lost productivity, unemployment, incarceration, and premature death. This public health and safety problem requires creative strategies that maximize resources to treat and prevent opioid use disorder.

Mathematica Policy Research is working with federal, state, and local governments as well as foundations and research organizations to help combat the opioid epidemic. Our researchers combine advanced analytic methods with in-depth knowledge of substance abuse and mental health service delivery to help policymakers monitor and react to changes in opioid misuse. We also apply economic and epidemiologic principles to better recognize unintended consequences and long-term ramifications of interventions intended to reduce opioid use.

Our work provides critical information to help policymakers, health care systems, and insurers do the following:

○ Measure and monitor opioid misuse and overdose deaths

○ Facilitate access to effective treatments for opioid misuse

○ Evaluate strategies to prevent opioid use and related harms
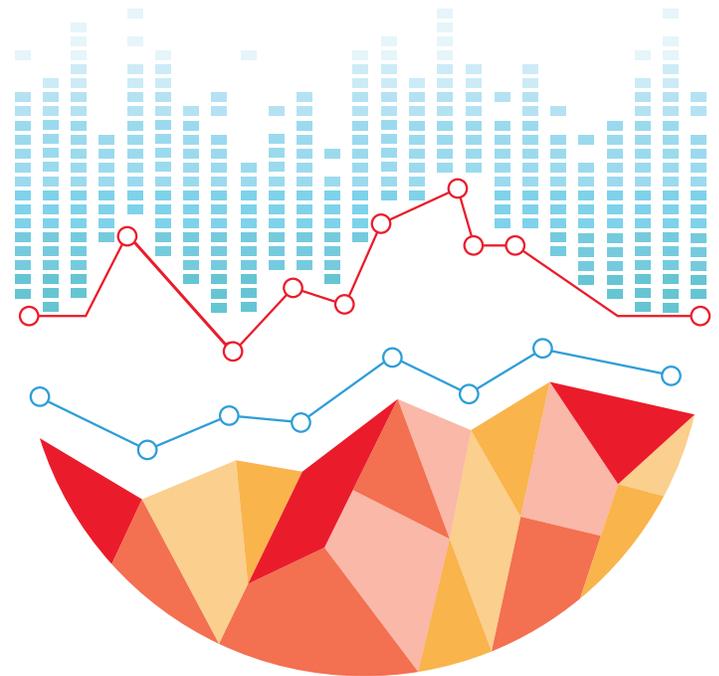
Measuring, Monitoring, and Predicting Opioid Misuse and Overdose Deaths

Mathematica uses innovative methods to identify data sources, data summaries, and predictive methods to monitor and anticipate opioid-related harms.

REAL-TIME MONITORING OF DRUG USE THROUGH WASTEWATER TESTING. Cities can use municipal wastewater testing to examine how the mix of drugs in their communities changes over time. The ability to test for multiple substances in a single wastewater sample can help officials identify when and where potentially lethal combinations of drugs are being used. When coupled with geospatial mapping and social network analysis, wastewater testing could yield rich, real-time information to help officials predict rather than react to changes in opioid misuse.
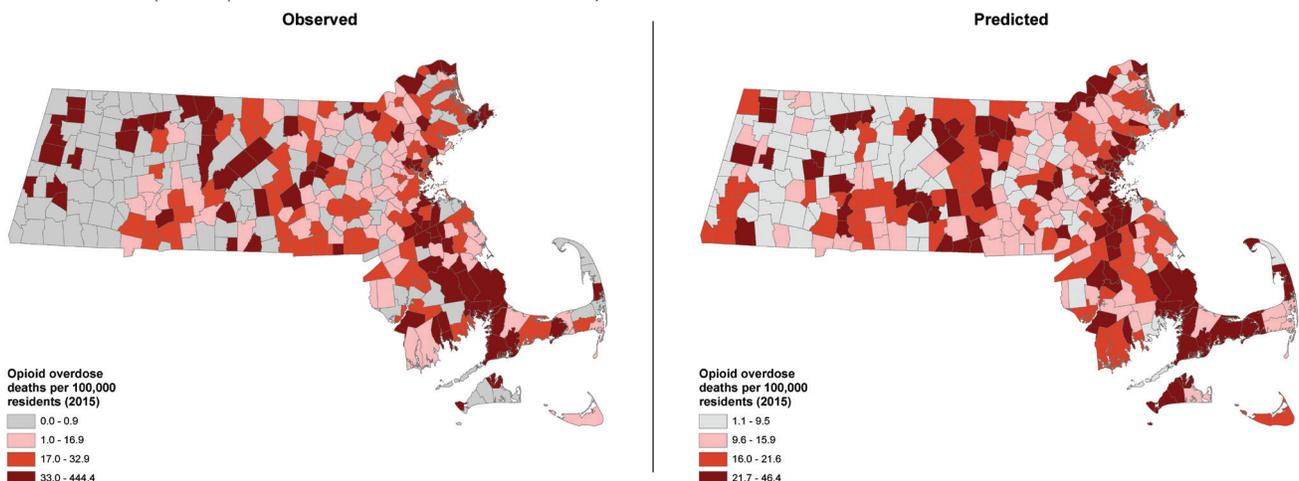
○ **Measuring.** With the support of the Laura and John Arnold Foundation, Mathematica explored the potential of municipal wastewater testing to measure opioid and other substance use in a community and identify emerging drug threats. Testing wastewater is an innovative way to obtain measures of drug use that are more timely, cost-effective, comprehensive, and objective than is possible with traditional surveys, which often take years to administer and analyze. Wastewater-based estimates of drug use have been validated against population survey estimates in Europe and Australia. When combined with data on medical use of opioids (such as data from prescription drug monitoring

programs), wastewater data can be used to tease out heroin use from prescription opioid use.

○ **Monitoring.** Mathematica is working with the Centers for Medicare & Medicaid Services to develop clinical quality measures that health plans, states, and federal agencies can use to monitor opioid overuse and prevent overdoses. These measures are based on data from electronic health records (EHRs) and follow Centers for Disease Control and Prevention guidelines for prescribing opioids for chronic pain. A measure to identify potential opioid overuse is currently in development using EHR data on opioid therapy dose and duration, with the goal of reducing high-dose opioid use among long-term opioid users.

○ **Predicting.** Mathematica researchers are exploring how advanced analytic techniques can be used to predict adverse outcomes and identify regional hotspots of drug use where interventions are needed most. We developed a predictive tool for opioid overdose deaths in Massachusetts by applying machine-learning techniques to an integrated dataset composed of publicly available data from health and law enforcement sources. The tool predicted how Massachusetts cities and towns ranked based on the number of opioid overdose deaths.

Predicting hot spots of opioid overdose deaths in Massachusetts

The machine-learning model was validated by comparing the predicted opioid overdose death rate in each city or town with the actual (observed) rate, based on data from the Massachusetts Department of Public Health.

Observed

Opioid overdose deaths per 100,000 residents (2015)
- 0.0 - 0.9
- 1.0 - 16.9
- 17.0 - 32.9
- 33.0 - 444.4

Predicted

Opioid overdose deaths per 100,000 residents (2015)
- 1.1 - 9.5
- 9.6 - 15.9
- 16.0 - 21.6
- 21.7 - 46.4

Facilitating Access to Treatment for Populations with Opioid Use Disorder

To improve access to treatments for opioid use disorder, Mathematica leverages both quantitative and qualitative methods to more holistically understand gaps in care, barriers to treatment, and populations with unmet needs.

IDENTIFYING HIGH-RISK POPULATIONS USING DYNAMIC DASHBOARDS. Dynamic dashboards help decision makers quickly understand contextual information on opioid use in their communities. Mathematica researchers created **S.T.Op NextGen**—an interactive provider portal intended to stop the transmission of opioids to the next generation by reducing neonatal opioid dependence, unintended pregnancies, and the involvement of child protective services. The dashboard aims to help providers prioritize treatment for women of child-bearing age at risk of opioid misuse. It contains national and local opioid-related death rates, patient-specific information on the risk of developing opioid misuse, and a tailored treatment locator that factors in key barriers to treatment such as cost, transportation, and child care.

For nearly 20 years, Mathematica has worked with the Substance Abuse and Mental Health Services Administration (SAMHSA) to gather detailed information on treatment facilities and the patients they serve.

We conduct and analyze national surveys of substance use treatment facilities that do the following:

- Provide real-time information for online treatment locators used for treatment referrals
- Identify treatment gaps and best practices
- Characterize state and national trends in service availability

Each year, we administer SAMHSA's National Survey of Substance Abuse Treatment Services to obtain information about the availability of treatments for opioid use disorder—including medication-assisted therapy—and other services from all known substance abuse treatment facilities in the United States. This survey also provides real-time information that feeds into SAMHSA's online Behavioral Health Services Treatment Locator, used by providers and people with substance use disorders to find nearby treatment facilities.

Preventing Opioid Misuse and Opioid-Related Deaths

Mathematica is conducting rigorous evaluations of opioid prevention, treatment, and recovery strategies for federal and state clients to identify those that are ready for replication.

CHANGING PRESCRIBING BEHAVIORS. To help reduce the supply of opioids, Mathematica led a pilot study to determine whether changes in EHR prescribing defaults affect the number of pills dispensed. Prescribing defaults are just one example of how EHRs can be mined to reduce the risk of patients developing opioid misuse. The use of natural language processing to systematically extract unstructured data from EHRs can be coupled with machine-learning algorithms to classify patients into low-, medium-, or high-risk categories for opioid misuse based on patient-specific clinical or demographic characteristics.

For SAMHSA's State Targeted Response to the Opioid Crisis grant program, we are employing rapid-cycle evaluation methods to assess the success of selected programs across the nation in increasing key behavioral

health indicators, including:

- Abstinence from opioids and other substances
- Completion of treatment for opioid use disorder
- Employment, educational attainment, and mental health functioning

Our work with states' decision makers has involved interviewing public and private health insurers to systematically collect information on their use of novel strategies to curb opioid misuse, like integrating behavioral and physical health care and conducting clinician and member outreach and education. Mathematica also monitors the success of program implementation by examining barriers and challenges faced by programs, efforts to address disparities, and plans for sustainability.

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