

Health

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.

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.

- **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 (CMS) 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)

Mathematica 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.

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.

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.

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

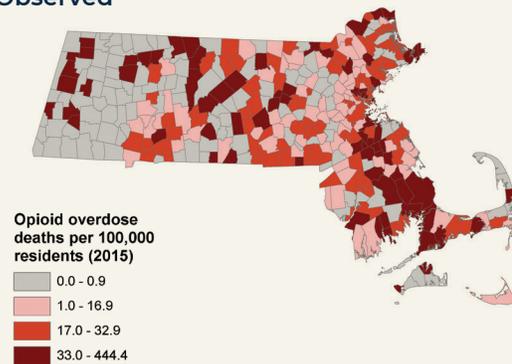
Real-time Monitoring of Drug Use through Wastewater Testing

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.

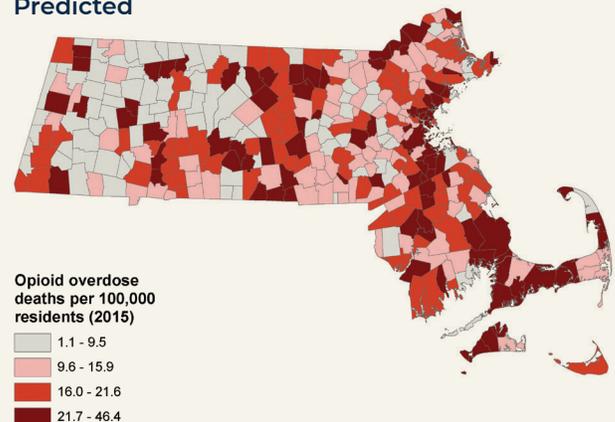
Predicting hot spots of opioid overdose deaths in Massachusetts

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



Predicted



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.

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.

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.

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.

Using the Transformed Medicaid Statistical Information System (T-MSIS) data

To understand the opioid epidemic and identify effective policies to combat this public health crisis, policymakers need data on the prevalence and incidence of opioid use and the costs associated with misuse and treatment of opioid use disorders. One critical source of data will come from the national Medicaid and Children's Health Insurance Program (CHIP) data system known as the Transformed Medicaid Statistical Information System (T-MSIS). T-MSIS data support analyses of:

- Medicaid and CHIP beneficiary enrollment patterns and demographic characteristics, including enrollment in delivery systems (fee-for-service or managed care) and waiver programs (1115(a) demonstrations and 1915(c) home and community-based services waivers)
- Utilization overall, by beneficiary subgroups, and by service setting (inpatient, outpatient, physician offices, community health centers, and long-term care facilities)
- Costs of care
- Providers and managed care plans

T-MSIS includes eight files: an eligibility file with detailed enrollment records for each beneficiary, four claims files (inpatient,

long-term care, pharmacy, and other services), a provider file, a managed-care plan file, and a third-party liability file. All but the third-party liability file have been optimized for research purposes and are known as the T-MSIS Analytic Files (TAF). Five of the TAF—the Annual Demographic and Eligibility file and the four claims files—have been de-identified and are available as Research Identifiable Files (TAF RIFs) from the Research Data Assistance Center. The TAF RIFs include a universal beneficiary identifier that allows easy linkage to Medicare data for those dually eligible for Medicare and Medicaid, and this identifier facilitates tracking of beneficiaries over time and across states.

Mathematica worked with CMS to create this report using the 2017 TAF data. The report includes SUD treatment statistics for Medicaid beneficiaries, including the number of Medicaid beneficiaries in each state treated for opioid use disorder (OUD). The data book identified almost 4.1 million Medicaid beneficiaries (nearly 8 percent) who were treated for a SUD in 2017. Of these beneficiaries, nearly 1.2 million (slightly less than 29 percent of those treated for a SUD) were treated for an opioid use disorder.

The report also includes an appendix with a series of OUD-specific tables, including the number and percentage of Medicaid beneficiaries treated for OUD by enrollment category, service type, service setting, and delivery system. In addition, the appendix includes information on the average number of OUD services received by Medicaid beneficiaries and the progression of care for beneficiaries who received services in an inpatient or residential setting.

T-MSIS Substance Use Disorder Data Book

Mathematica supported CMS's recently released inaugural Substance Use Disorder (SUD) Data Book using 2017 Transformed Medicaid Statistical Information System (T-MSIS) data. Congressionally-mandated through the Substance Use-Disorder Prevention that Promotes Opioid Recovery and Treatment for Patients and Communities Act (SUPPORT Act), the T-MSIS SUD Data Book reports the number of Medicaid beneficiaries with a SUD and the services they received during calendar year 2017, which was the most recent year of complete T-MSIS data available at the time of the analysis. The SUPPORT Act also requires a description of the quality and completeness of the data used in the SUD Data Book, which is presented in eight data quality briefs that accompany the data book.

The 2017 T-MSIS SUD Data Book is available at <https://www.medicaid.gov/medicaid/data-and-systems/downloads/macbis/sud-data-book.pdf>

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Mathematica applies expertise at the intersection of data, methods, policy, and practice to improve well-being around the world. We collaborate closely with public- and private-sector partners to translate big questions into deep insights that improve programs, refine strategies, and enhance understanding.

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