



Biobot Analytics

eBook

Turning the Tide On Opioid Overdoses



Turning the tide on opioid overdoses

In 2022 alone, the [CDC reports](#) that over 100,000 people died from overdose deaths in the United States. Of these many preventable deaths, almost three-quarters of all overdose fatalities involved [fentanyl](#) and other synthetic opioids. Despite sinking billions of dollars into countless interventions, our country has experienced annual, significant increases in both fatal and non-fatal overdoses.

The costs of the opioid crisis are unmatched by any other cause of early and midlife morbidity and mortality. On top of the enormous tolls of the emergent COVID-19 pandemic, the opioid epidemic cost Americans an [estimated \\$1.5 trillion dollars in 2020](#)—a 33% increase since 2018—and this cost is projected to continue rising in tandem with the increasing frequency of opioid overdoses. Indeed, in 2021 alone, the U.S. labor force was missing [1.3 million workers](#) due to opioid use.

The First Wave

This [opioid overdose epidemic](#) has hit the American public in three waves. First, with the commercial approval of Purdue Pharmaceutical’s time-released semi-synthetic OxyContin (oxycodone) in 1998, when there was an almost immediate rise in natural and semi-synthetic opioid-related deaths. This sudden rise in problematic prescription opioid use is due in large part to [Purdue’s misleading marketing practices](#), which deliberately misrepresented their product’s dangers and relative safety compared to pain medication alternatives. Purdue and Abbott Laboratories also aggressively marketed OxyContin as a [treatment for “non-malignant” diseases](#) like arthritis and chronic back pain, which are [disproportionately experienced](#) by people with lower socio-economic status. OxyContin sales grew [more than 30x](#), from \$49M in its first year to \$1.6B in 2002. By 2009, Americans’ risk of overdose fatality due to commonly prescribed opioids had [quadrupled](#) and OxyContin had become the most popularly prescribed Schedule II narcotic drug in the United States.

The Second Wave

The second wave of the opioid epidemic came in 2010, as public consciousness shifted and there began to be a limiting of prescriptions and dosages to abate the overdose death toll. Yet, these changes to prescribing left individuals who had been relying on these potent medications to face either withdrawal or the process of finding another source of opioids—often in the form of heroin. From 2010 to 2012, the mortality rate due to heroin overdose deaths [more than doubled](#).

The Third Wave

By 2013, we entered our third and current stage of the opioid epidemic, in which far more potent, synthetic opioids, like fentanyl, pervade the drug supply. These synthetic opioids are driving a persistent increase in opioid-related overdose fatalities, with a [disproportionate impact on people of Color](#). Clearly, the reckless prescribing, manufacturing, and marketing of narcotics demands accountability for the perpetrators and restorative justice for the communities they’ve damaged.

To that end, in 2021 and 2022, attorneys general in almost every state reached financial settlements to resolve opioid litigation, resulting in \$56B settlement funds for states to improve prevention, treatment, and recovery for opioid use.

These funds provide an incredible opportunity for communities to target and assist populations most in need while turning the tide on the opioid epidemic once and for all. While significant, they are far from unlimited. We must use these funds to save the most lives possible and finally turn the tide on this *preventable* and persistent wave of deaths.

ABOUT THE AUTHORS

[Biobot Analytics](#) is a global leader in wastewater epidemiology, founded with the goal of transforming wastewater infrastructure into real-time public health observatories. Having worked at hundreds of locations across all US states and territories and several countries, Biobot produces actionable information from wastewater to improve the health of communities around the world. Separately from their infectious illnesses work, Biobot also analyzes wastewater for the presence of [High Risk Substances](#), such as opioids, to help communities better respond to substance use and implement harm reduction programming.

[The Steadman Group](#), LLC (TSG) is a woman-owned health care consulting business based in Colorado with consultants around the country. TSG is certified as a Women’s Business Enterprise, a Women-Owned Small Business, and a Public Benefit Corporation (B-Corp). Our mission is to improve the health of people and communities, and to provide exceptional service to those who share this commitment. Our behavioral health division’s purpose is to transform individuals’ lived experience into an asset by assisting organizations that serve people with mental health and substance use disorders. Our team is comprised of experts with extensive knowledge and experience in opioid settlement facilitation and advancing the implementation of evidence-based practices through policy advocacy, policy, program design, capacity building, and evaluation.

Best Practices in Spending Allocation

While there are no clear answers on how to achieve the goal of saving the most lives possible while turning the tide on opioid related deaths, many highly knowledgeable people have spent a great deal of time deliberating over best practices for opioid settlement spending. We should adhere to those. There are a number of independently produced, concordant documents that highlight best practices for allocating and spending opioid abatement fund dollars efficiently. Minnesota’s Department of Health provides an excellent example of one such summary [here](#).

Below, you can find the guiding principles prepared by the [Johns Hopkins Bloomberg School of Public Health](#) incorporating recommendations from a coalition of more than 30 medical, academic, public health, and advocacy organizations, which are often cited throughout best practice guides offered by a variety of actors.

1. Spend money to save lives.
2. Use evidence to guide spending.
3. Invest in youth and family prevention.
4. Focus on racial equity.
5. Develop a fair and transparent process for deciding where to spend the funding.

Our focus in this paper is recommendation #2 above—using evidence to guide spending. Ultimately, we see this evidence, or data, as essential to implementing all other recommendations. How can we know which intervention saves the most lives, or which of those is most feasible to fund locally, without the outcomes and costs data to prove it? And which of those interventions is most relevant to existing community needs? Clearly, settlement fund decision makers need to rely on an array of data sources to sort these questions out. But which data is the most relevant and reliable? Do the data we need even exist?

For all we know about overdoses, significant gaps in substance use monitoring data remain. For instance, very few states have an accurate, timely prevalence of opioid use itself; even fewer have sub-state prevalence data. With a base layer of data on community use of opioids and other illicit substances, communities are armed with quick information on program effectiveness. They can deploy life-saving interventions to areas most in need.

The large infusion of money coming into communities is, in many cases, somewhat overwhelming. Crucially, establishing data sources, reporting frameworks, and data infrastructure early on in this process creates transparency in the use of funds and programs they support. This in turn cultivates community trust in interventions and programs, which facilitates the programs’ success. Moreover, a robust data collection, monitoring, and evaluation framework will create opportunities to iterate on spending efforts based on outcomes. With this kind of “Plan-Do-Study-Act” cycle, you will empower your region to better target and expand programs that are *actually serving the community* and use funds most efficiently.



The power of wastewater data

While some data sources may require entirely new infrastructure, one is right under our noses (or, ahem, other body parts). Our own wastewater contains metabolites of virtually every substance used in our community, including illicit substances, prescribed substances, and treatment medications. At a low cost, we can monitor the opioid epidemic at remarkably high resolution. Thus, wastewater is uniquely positioned to fill the gap in data on consumption of opioids and other substances in behavioral health monitoring and bring together many sources of data with continuous insights. Below are just a few of the benefits of wastewater data:

1. **Equity:** Unlike many data sources, everyone has a voice in the sewers. Wastewater is not biased by household income, race, or gender. Looking at wastewater data ensures that nearly everyone is counted equally.
2. **Population coverage:** Anyone that uses a toilet connected to a sewer system—**80% of American households** and almost all commercial and public restrooms—is included in wastewater data analysis. We can determine where people use what substances.
3. **Privacy:** There are no identifying data attached to wastewater. By using large enough catchment areas, wastewater data can ensure that individuals’ substance use or treatment status are impossible to identify.

4. **Cost-effective:** For about ten cents per person per year, wastewater monitoring provides comprehensive data on substance use rates.
5. **Real-time reporting:** Most current data sources take months or years to come to fruition. Wastewater data can be processed and made public within days of substance use. It's the fastest data available, far faster than even overdose data, which can take up to six months to process.
6. **Long-term availability:** Wastewater can enable planning and forecasting to understand any trends or seasonality in substance use patterns, which in turn improves long-term planning, prevention, treatment, and harm reduction efforts.
7. **Broad relevance:** Wastewater data pairs easily and comprehensively with other sources of information, like EMS calls, hospitalizations, and police response incidents.
8. **Immediacy:** Wastewater monitoring generates data that enables reactive, real-time intervention to spikes in prevalence. For example, communities can dispatch harm reduction teams and double street outreach in communities when a specific threshold is reached with high risk substances in the wastewater.

When it comes to evaluating wastewater data against existing overdose data sources, including 911 calls, emergency department (ED) chief complaints, ED/Hospitalization ICD-10 coded, and death records) [Marin County](#) used the following framework:



Timeliness



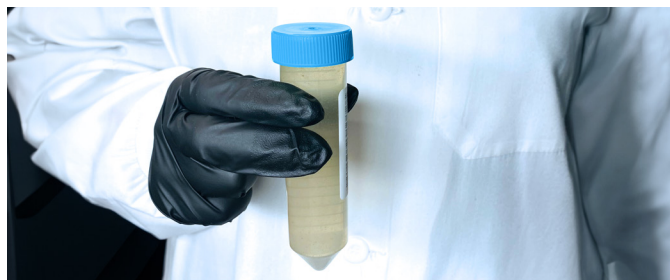
Population coverage



Accuracy / standardization



Substance specificity



Several data sources are limited when it comes to overdose monitoring, given inequities in healthcare access and the hesitation amongst the population of people who use drugs to access services. “With wastewater we have the opportunity to capture people who are not accessing services as well as those who are accessing our services.”¹¹ Other records, such as overdose deaths, have similar limitations in that, data collection processes change over time and may not have full specificity of substance involvement. Finally, surveys can capture people’s subjective experiences of use, but they are expensive, time-consuming, and still subject to many of the participation biases mentioned above.

Wastewater is like an inexpensive survey that’s completed immediately with 100% participation and complete truth. It also covers populations left out by more traditional monitoring activities, like historically marginalized communities who opt out of typical behavioral health surveys due to government distrust but remain highly likely to use a restroom—public or private—that empties into the local watershed. Even with this inclusion, wastewater data maintains people’s anonymity.

Many public health officials consider wastewater data a valuable yet highly underutilized epidemiological data source for behavioral health monitoring. For instance, [Nevada’s 2022 Opioid Needs Assessment and Statewide Plan](#) scores the “[improvement] and [standardization] of forensic toxicology testing and data”, which explicitly includes wastewater monitoring, as one of their top 10 most impactful data recommendations to benefit to the community. Nevada’s intervention impact rating for wastewater-based epidemiology (WBE) is on par with their scores for many substance use prevention staples, such as:

- Screening, Brief Intervention, and Referral to Treatment (SBIRT) training for primary care providers
- Public stigma marketing campaigns
- Low-threshold buprenorphine prescribing
- Screening for social determinants of health

Nearly all health care and public health approaches to behavioral health contain these valuable interventions, and wastewater monitoring is ranked as high or higher in value than all of them.



Putting wastewater data into action: Evidence from Cary, North Carolina

Biobot Analytics partnered with **Cary, North Carolina's** local leaders to provide timely and comprehensive data on substance use trends. This data helped Cary officials target their community outreach efforts and reduce the number of opioid overdoses. More inclusive than traditional public health indicators, the data distinguished between “parent drugs” (unconsumed drugs) and their metabolites (consumed). Biobot’s data and the city of Cary, NC’s community action plans translated into:

- **A 40% reduction in annual overdoses.**
- An understanding of the scale of substance abuse with the insight that naloxone (often known by its brand name, Narcan) consumption **exceeded overdoses 25-to-1**, suggesting that **up to 25 times more people were overdosing than what was reported** through emergency services.
- Dramatically increased proper disposal of medications, with Cary **disposing of 2.5 times more prescription medications through take back events** the year after the program began: from 924 pounds of medication to 2,511 pounds.

Altogether, Cary’s use of wastewater monitoring data for high risk substances is a success in complementing incomplete data and meaningfully impacting the local opioid epidemic. They achieved these effects by taking Biobot data and applying it to comprehensive community outreach programs, providing a vivid illustration of how wastewater analytics can inform community responses to substance use. Specifically, it can help evaluate program effectiveness, optimize naloxone distribution, equip EMS with real-time knowledge on emerging drugs, and so much more. As the opioid epidemic persists, Biobot will continue expanding its wastewater platform to analyze even more high-risk substances and contribute to more success stories like Cary.

The Possibilities

The particular cost-benefit of wastewater monitoring for high-risk substances has not yet been studied. But we can imagine its possibilities, based on the success of WBE as a **highly-beneficial and cost-effective** form of community COVID-19 monitoring. Wastewater data can enable data analysis and evaluation that has never been available, making other evidence-based practices even more effective by putting them in the right place at the right time. We have no doubt that using best practices augmented by wastewater monitoring of high risk substances will improve their cost-benefit ratio and, in turn, spawn entirely new interventions with unprecedented evidence behind them. Your public health department can be part of this innovation. Imagine a minor tweak to an existing program that improves its effectiveness twofold!

For instance, we know that many harm reduction programs are resource-limited. However, many of them hand out naloxone at a similar rate all year. Using wastewater data, when a spike in fentanyl is seen, harm reduction organizations could increase naloxone distribution sites to help mitigate overdose deaths. Here are some other examples of how wastewater has already improved monitoring and resulted in better programs.

1. Identifying emerging drugs through wastewater

Identifying new substances in the illegal drug supply before they present in overdose cases can give state, city, and county health officials important lead time to build interventions, education, and awareness campaigns. One county already putting this potential use into action is the County of Marin, in California. They knew xylazine was present across the Golden Gate Bridge in San Francisco, but weren’t sure yet if it had entered Marin County. They asked Biobot early on in their High Risk Substances pilot program if the tranquilizer drug could be tested for. Biobot quickly developed an assay to test for the substance and discovered both xylazine and its primary human metabolite in the county’s wastewater. This confirmed county health officials’ reports of community members presenting with symptoms of xylazine ingestion. Confirming suspicions and understanding the mix of drugs in the illegal supply helped Marin County prepare their health workers and issue a public health advisory before the drug was ever detected in decedent toxicology.

2. Partnering effectively with first responders to save lives

Cities and towns across the nation have begun collaborating with local law enforcement agencies to reduce overdose fatalities by equipping their units with naloxone and training officers on overdose reversal. From 2019 to 2020, the city of Denver, Colorado, distributed 5,415 naloxone kits to law enforcement agencies across the state. These kits were provided by the state’s Office of Behavioral Health and their [State Opioid Response program](#). By monitoring wastewater, naloxone and fentanyl test strip distribution efforts can be informed by where and how much xylazine and fentanyl are in the wastewater. This data enables communities to get ahead of harm reduction strategies that can help their first responders and community actors prepare for when supplies are needed most and get those resources where they need to be.

3. Targeting harm reduction efforts in areas traditionally overlooked

Sometimes a subset of the population is overlooked as drug users because the neighborhood is traditionally viewed as affluent and does not require regular law enforcement intervention. Other times, it’s because a community is reluctant to use emergency services, such as the undocumented or unhoused communities, or even those that are drug users.

Wastewater data, being comprehensive and including anyone that uses a toilet, has the power to highlight where interventions are needed that may not be at the EMS/overdose/ED visit level yet or among those groups where there is a stigma against using emergency services. Early intervention or intervention in areas that were not on the community radar can help turn the tide on overdoses as well as help reduce the supply.

4. Evaluating prevention programs and anti-stigma campaigns:

While we know that prevention works, we can improve its use, especially for new campaigns. Say, for instance, a school district rolled out a new education and prevention campaign for youth nicotine use. A neighboring school district with similar characteristics decides not to roll out a campaign. Wastewater monitoring of schools could provide a completely anonymous evaluation of the campaigns, even examining whether campaign intensity in a specific school resulted in greater drops in nicotine use.

5. Evaluating new treatment opportunities:

We know that medications for opioid use disorder work well. Say, for instance, a new opioid treatment program, which uses methadone to treat people with OUD, pops up in a neighborhood. Wastewater monitoring could quantify the increase in methadone use and, hopefully, the decrease in illicit opioid use, all without accessing highly-confidential patient records.

Conclusion

In the face of an escalating opioid crisis that has claimed hundreds of thousands of lives, the urgent need for innovative solutions and strategic resource allocation has never been clearer. Wastewater monitoring for opioids and other high-risk substances is an innovative, underexplored resource with immense potential. The power of wastewater data lies not only in its comprehensiveness and real-time reporting but also in its ability to provide actionable insights that traditional data sources often miss. WBE for high-risk substances serves as a crucial input in the allocation of significant but finite resources provided by opioid settlement distributions to fight the opioid epidemic.

By embracing the power of wastewater data, communities save lives and optimize the impact of their interventions. The promise of this innovative approach is not just a theoretical possibility. WBE, in combination with spending best practices, is a tangible, actionable solution that can help turn the tide on the opioid epidemic and create a future where preventable overdoses are a thing of the past. It is through these concerted efforts, rooted in data-driven decision-making and guided by best practices, that we can build healthier, safer communities for all.



Interested in learning more about Biobot’s High Risk Substance testing for your community?

Reach out to us at hello@biobot.io. If you’d like to learn more about opioid settlement best practices and strategic plan development, we’re excited to hear from you via info@steadmangroup.com.