Cracking the Code: Using Data to Combat the Opioid Crisis

Catherine Martinez

Introduction

The human cost of the opioid crisis is accelerating. According to estimates, the number of overdose deaths in 2016 was over 59,000, the largest annual jump in American history.[1] In October 2017, President Donald Trump directed the Department of Health and Human Services (HHS) to declare the opioid crisis a public health emergency.[2]

Could data contribute to our understanding of the crisis and aid in combating it? Relevant data, including deaths, overdoses, use of naloxone, and drug arrests, come from different sources and are collected by different agencies. But the mere collection of relevant data does not solve the opioid crisis. The quality of the data matters, as does consistent and frequent reporting. Further, access to accurate data is key in generating policy recommendations and effectively directing resources. Currently, there is a risk that data is not collected efficiently, that "bad" data is collected, and that data is not being shared or analyzed effectively. As a result, we may have "gaps" or "blind spots" in our approaches to the opioid crisis, while the lack of real-time data and delayed publication may also hamper efforts to react in a timely manner.[3]

There are already indications that this may be a problem. As John Carnevale at the Office of National Drug Control Policy stated, "We're simply flying blind when it comes to data collection, and it's costing lives."[4] Further, the lack of coordination between state agencies, among states, and between states and the federal government hampers our ability to use data. Differences in how states collect, store, and analyze data may also stymie such efforts, while data sharing regulations regarding pose another hurdle.

State officials have already begun to call for reform in data collection and sharing.[5] These improvements could lead to possible benefits. They could help not only track the spread and severity of the crisis, but also help evaluate how to best expend resources. They could also help identify emerging trends, such as changes in the demographics of overdose deaths or to track the supply of fentanyl-laced heroin on the street. For example, improvements could help emergency response teams prevent fatal overdoses by allocating resources, such as Narcan, in areas with higher rates of overdoses. They could also lead to better determinations regarding the placement of opioid-treatment facilities, as Indiana did, by using mapping overdose hotspots to decide where to place new clinics.[6] They could yield insights into the populations most at risk of developing substance use disorders, and help officials target those populations for increased resources like

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The Journal of Law, Medicine & Ethics, 46 (2018): 454-471. © 2018 The Author(s)
DOI: 10.1177/1073110518782953

https://doi.org/10.1177/1073110518782953 Published online by Cambridge University Press

information campaigns, treatment services, and community outreach. Meanwhile, harnessing existing data collection systems, such as prescription drug monitoring programs, and analyzing them in real-time could help law enforcement identify over-prescribers and "doctor shoppers." And once decisions are made, the data gathered could help to evaluate their effectiveness and adapt and amend policies.

However, there are serious concerns regarding the cost of these improvements. Having access to more data does not matter if that data is not used. There is a risk that collecting more data may simply present the *illusion* of action, while not leading to concrete benefits. Additionally, a campaign to improve data sharing and collection would have serious administrative, agency, and information costs. This article is therefore not calling for unlimited collection and sharing of data, nor for the immediate implementation of data sharing initiatives without a consideration of their costs and benefits.

Instead, the goal of this article is to understand the value of data and to call for efforts to explore improved data sharing and collection among local, state, and federal agencies. It discusses the data available and existing barriers to sharing it. It also looks at examples of data sharing initiatives and analysis, such as mapping and visualization tools. The article then examines relevant regulations and calls for reforms. Finally, the article considers objections, including privacy interests, data security, and the costs and benefits of data sharing initiatives.

A. Brief Overview of the Problem

Public officials have already identified data gaps as part of the problems they currently face. In November 2017, the President's Commission on Combating Drug Addiction and the Opioid Crisis noted in its final report that "data on drug use, treatment, and public safety outcomes are managed in different agencies and are often not integrated in a comprehensive way that facilitates the needs of public safety and public health."[7] The Commission's concerns echo those from both public and private actors about the quality of existing data. Some state agencies have reported problems with gaining access to data,[8] while others have noted deficiencies in the collection of data by the federal government,[9] while still more have expressed concern about delays in the publication of data.[10] Researchers, too, are worried. One study identified multiple data gaps, including the "[a]verage amount consumed per event among nonmedical users," the "[a]mount acquired via doctor shopping and forgery," and the "[r]ates of overdose and all-cause mortality among select classes of nonmedical users."[11] Clearly, concerns about data relating to the opioid crisis have been voiced repeatedly in recent years.

Instead, the goal of this article is to understand the value of data and to call for efforts to explore improved data sharing and collection among local, state, and federal agencies. It discusses the data available and existing barriers to sharing it. It also looks at examples of data sharing initiatives and analysis, such as mapping and visualization tools. The article then examines relevant regulations and calls for reforms. Finally, the article considers objections, including privacy interests, data security, and the costs and benefits of data sharing initiatives.

B. Background

This section briefly examines the background of public health and syndromic surveillance systems and PDMPs. It also looks at examples of applications of public health and syndromic surveillance systems to the opioid crisis. These examples demonstrate the potential benefits of improved data collection and sharing and highlight the urgency of identifying solutions. This article explores the potential of applying such systems to the opioid crisis and evaluates obstacles hampering the ability to do so on a wider scale.

i) Public Health and Syndromic Surveillance

Public health surveillance is "the ongoing, systematic collection, analysis, interpretation, and dissemination of data ... to reduce morbidity and mortality,"[12] while the objective of syndromic surveillance is to "identify illness clusters early, before diagnoses are confirmed and reported to public health agencies, and to mobilize a rapid response."[13] Syndromic surveillance sys-

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https://doi.org/10.1177/1073110518782953 Published online by Cambridge University Press

tems use "surrogate" data sources, such as over-the-counter prescription sales or school absenteeism.[14] Coupled with access to health data, such systems have been successfully used to stop disease outbreaks, such as a norovirus, in the twenty-first century.[15] Syndromic surveillance systems implemented in Uganda in 2002 successfully detected two malaria outbreaks two weeks before case numbers began to peak,[16] while another system in French Guiana helped provide an early warning for military personnel for cases of dengue fever among soldiers.[17]

Could these models be applied to the opioid crisis? After all, the crisis generates data points like those traditionally used in detecting and tracking disease outbreaks, like death certificates and emergency room visits. And while the detection of patterns in the opioid crisis may differ from that used in mapping the spread of a disease, similar lessons can be learned.

The CDC and HHS have already indicated that they seek to apply such lessons to the opioid crisis. In March 2017, Dr. Debra Houry, director of the National Center for Injury Prevention and Control, testified before the House Committee on Energy and Commerce that the CDC's efforts were focused on "strengthening surveillance," including "improving data quality, data timeliness, and tracking trends to monitor the epidemic."[18] As Dr. Houry noted, the CDC has also engaged in funding efforts to assist states with public health surveillance.[19] In 2016 and 2017, the CDC's Enhanced State Opioid Overdose Surveillance grant program awarded $12.8 million to thirty-two states to increase the timeliness of reporting "nonfatal opioid overdoses through syndromic surveillance," "fatal opioid overdoses," and to "[d]isseminate surveillance findings to key stakeholders in order to inform prevention and response efforts for opioid-involved overdoses."[20] In 2016, HHS also began funding efforts through the Prescription Drug Overdose Data-Driven Prevention Initiative, which awarded $6 million to thirteen states and Washington, D.C. to enhance their ability to "[i]mprove data collection and analysis around opioid misuse and overdose."[21] Clearly, the CDC and HHS believe that public health surveillance can be useful. Given that their efforts are so recent, and many states have yet to fully use the funding, it is difficult to assess their potential impact. Still, these efforts highlight the desire to facilitate data collection, reporting, sharing, and analysis.

Outside of the CDC and HHS's efforts, individual states and cities have already shown their own initiative in using public health or syndromic surveillance with particular datasets. Many of these systems use overdose data from hospitals and emergency departments. For example, New Hampshire's Department of Health and Human Services began to use the state's Automated Hospital Emergency Department Data syndromic surveillance system to track opioid-related overdoses in 2013.[22] This data has since been used to estimate the severity of the opioid crisis in New Hampshire.[23] Meanwhile, Massachusetts's Department of Public Health has used data analytics to "spot patterns and to devise an early warning system about hotspots in the state where possible overdoses and deaths might occur."[24] Rhode Island's Department of Health passed emergency regulations in April 2014 that "require all hospitals and emergency departments to report cases of opioid overdose within forty-eight hours" to the department, resulting in the development of an Opioid Overdose Reporting System.[25] The system is intended to "identify clusters of overdoses in near real time to target interventions in high-risk areas and to vulnerable populations."[26] In September 2016, Virginia followed suit and began publishing monthly data online on emergency department visits for overdose by opioids, unspecified substances, and heroin.[27]

Other systems use information inputted by emergency response teams in the field to help make better decisions about where to allocate resources. Cincinnati, Ohio, for instance, developed a "heroin tracker"[28] that uses emergency services response data of reported heroin overdoses to "identify trends and geographic 'hotspots.'"[29] Similarly, Louisville, Kentucky's emergency services use data tracking technology that enables responders to enter data on overdoses in the city and updates the agency's database in real time.[30]

Meanwhile, other systems use law enforcement data, such as arrests and crime reports. Indiana, for example, launched an online opioid data center, which includes "information on drug arrests, drug seizures, death records, pharmacy robberies, overdose-related ambulance calls, and the use of naloxone" and uses data-visualization tools to help users analyze the data collected by the center.[31] However, it is important to note that many of these efforts are quite recent, making it difficult to assess their effectiveness. And there are indications that these systems may have limitations. Rhode Island's system, for instance, has suffered from issues of compliance with reporting requirements from hospital to hospital, as well as concerns of underreporting.[32] Still, these efforts illustrate the potential promise in expanding similar initiatives to other cities, states, and on a national level.

ii) Development of Prescription Drug Monitoring Programs

While many of the examples discussed were developed in the last decade, prescription drug monitoring pro-

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grams (PDMPs) have a much longer history as data collection systems used to deal with substance abuse crises. Thus, the historical experience with PDMPs may provide insight into developing other data sharing initiatives or improve upon existing ones.

PDMPs are state-level electronic databases that record prescriptions of controlled substances and aim to prevent "doctor shopping."[33] They are accessible by authorized users, including prescribers,[34] and enable physicians to "adjust their prescribing decisions"[35] based on patient prescriptions. Essentially, they are meant to help physicians act as "opioid gatekeepers."[36]

As of 2017, all fifty states and Washington, D.C. have some form of PDMP.[37] Some states have continued improve their PDMPs by integrating access to electronic health records.[38] But because state PDMPs are regulated state-by-state, they vary in how they work and any legal restrictions on sharing.[39] Thirty-eight PDMPs are operated by the state health agency, while six are operated by state law enforcement agencies.[40] They also vary according to the drugs monitored, access to records by law enforcement and by non-law enforcement actors, and whether participation is voluntary.[41] Of course, this variation may be a feature, rather than a bug, as it allows states to tailor their PDMPs and assess which legal requirements for prescribers work best in decreasing opioid prescription rates.[42] However, this variation does pose problems for cross-state PDMP data sharing.

There is some indication that aggregating PDMPs may be useful for public health surveillance. One example is the Prescription Behavior Surveillance System (PBSS), which currently uses data from twelve states. The PBSS is meant to provide state health agencies with the ability to generate population-based metrics about the prescribing of controlled substances, with data about both prescribers and patients.[43] Data from PDMPs has also been used by state agencies to evaluate public health initiatives regarding prescribing rates. New York, for instance, used data from the state PDMP to evaluate whether targeted initiatives in Staten Island had an effect on opioid-involved overdose deaths relative to the other four boroughs, finding a 29% decline in Staten Island from 2011 to 2013.[44] This study indicates that PBSS and PDMP-type data could be used in evaluating the success or failure of different policies.

However, it is still unclear exactly how effective PDMPs are in decreasing prescribing rates.[45] Further, PDMPs may not be as effective without interstate data sharing. There are also concerns that PDMPs may violate civil liberties, particularly if they are used in criminal investigations.[46] Circuit and district courts have heard challenges to DEA-issued subpoenas of state PDMPs.[47] Three cases from 2017 indicate that Fourth Amendment challenges to law enforcement searches may face an uphill battle, with claims being dismissed because of issues of standing or qualified immunity, or because the court concluded that physicians and patients did not have a reasonable expectation of privacy in the prescription drug industry.[48] While this is good news for advocates of PDMPs, these cases also signal serious concerns about privacy.[49]

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II. Collection, Reporting, and Use of Data in the Opioid Crisis

As discussed, it may be possible to use data generated by the opioid crisis in public health and syndromic surveillance systems. But what data is currently available? Who creates and collects that data? Is it shared

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https://doi.org/10.1177/1073110518782953 Published online by Cambridge University Press

between local, state, and federal agencies? How is it analyzed? This Part seeks to answer these questions and attempts to establish a framework for data sharing. It also discusses the potential benefits of improvements in data collection and sharing and argues that efforts should be made to reform existing regulations.

A. Types of Data

First, it is important to understand the types of relevant data. Their sources tend to fall into two categories: health and law enforcement. There are several sources of health data, including PDMPs, state coroners/medical examiners, death certificates, Medicaid and other claims, insurance providers, and state emergency services.[50] Within each of these sources lie potentially useful data points. Emergency services data, for example, could include the number of overdoses, treatment admissions, emergency department admissions, and the number of 911 and poison control calls,[51] while death certificates may include information about the cause of death, the drugs involved, and demographic information, such as age, sex, marital status, race/ethnicity, and education level.[52]

Meanwhile, law enforcement data may also be a source of data. Certain aspects of the crisis intersect with illegal activity, such as prosecutions in relation to overdose deaths.[53] Additionally, police officers are often first responders to overdoses, and may be responsible for deploying naloxone.[54] Data from law enforcement sources may include state forensic labs, drug arrests, drug seizures, crime or incident reports, and urinalysis results.[55] Past programs have sought to collect and use data from law enforcement sources in surveillance systems of drug use and trends. The now-defunct Arrestee Drug Abuse Monitoring Program, for example, interviewed volunteer arrestees who provided urine for testing and information from these interviews was used to "help monitor trends in drug use."[56] Another example is the DEA's System to Retrieve Information from Drug Evidence, an former online database of drug seizure data.[57] Revitalization of these systems may yield insights for law enforcement in investigating and prosecuting, for example, suspected drug traffickers.

There are other sources of health and law enforcement data that may be useful. Successful data-driven efforts will therefore need to identify these sources, identify who collects the data, and determine ways to gain access before other issues — such as sharing and analysis — can be considered.

B. Data Reporting and Collection

Once potentially useful sources of data are identified, data sharing initiatives will need to ensure that the data is reported and collected properly. One major issue with existing data is the lack of standardization in how it is reported and stored.[58] Standardization is necessary in "(1) defining what to collect, (2) deciding how to represent what is collected (by designating data types or terminologies), and (3) determining how to encode data for transmission."[59] The lack of data standardization poses a significant hurdle to data sharing initiatives, as it makes it difficult to match datasets and derive insights through analysis. Ex-post standardization is an extra, unnecessary step that can be avoided by imposing common data standards.

Another issue is the form in which data is collected. Clinical data is collected in a variety of forms. In recent years, there has been a movement toward digitization through electronic health records (EHRs). EHRs can "contain a patient's medical history, diagnoses, medications, treatment plans, immunization dates, allergies, radiology images, and laboratory and test results."[60] Because EHRs are in a digital format, they can be shared more easily with other health care providers and agencies,[61] and therefore may more easily facilitate the sharing of data.

But EHR systems have not yet been adopted by all healthcare systems. The 2009 Health Information Technology for Economic and Clinical Health Act authorized the HHS Secretary to "invest in the infrastructure necessary to allow for and promote the electronic exchange and use of health information."[62] But as of 2016, only a little over sixty percent of all office-based physicians, twenty percent of nurse practitioners, and two percent of physician assistants have adopted EHR systems.[63] Adoption of digitization is ongoing, and until it has fully penetrated the market, some data will inevitably fall through the cracks. Meanwhile, non-digitized data can hamper data sharing and matching because datasets in non-digitized formats are unable to "talk" to each other or to datasets in digitized formats stored electronically.

Further, much of the data currently available is in data "silos."[64] When data is "siloed," that is, when it is kept or stored in different repositories that are unable to "talk" to each other, it is difficult to "match" datasets and identify trends across data sources.[65] As the Department of Commerce's Internet Policy Task Force noted, "[r]ather than coming up with an overall picture and then breaking it up into smaller pieces that mesh together, Congress has been sporadically creating individual pieces of ad hoc legislation.[66] This system of "sectoral data protection" causes "severe regulatory data gaps," "encourag[es] different levels of protection," and inhibits interagency cooperation.[67] Funding programs may also be siloed, further complicating the picture.[68]

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https://doi.org/10.1177/1073110518782953 Published online by Cambridge University Press

These gaps in the data are problematic because they can hamper the capability of relevant actors to act. Consider, for example, the numbers of children placed in foster care, which has reportedly exploded in recent years.[69] Some connect this increase to the opioid crisis, but it is difficult to make that connection directly when state child welfare databases do not collect information on what type of drug was a contributing factor to the child's removal.[70] According to one analyst, it is "hard to have enough substance abuse services for these families if we don't have an accurate idea of how many families are actually being affected by opioid abuse."[71] Thus, the lack of data in this context may lead to poorer outcomes or policies for children and families at risk. Or consider, for example, a possible data gap between law enforcement and hospitals with regards to fentanyl. Law enforcement may have access to data on the potency of heroin seized in drug arrests. That same data may be relevant to emergency rooms in treating potential overdose cases,[72] but it is worthless to them unless that data is communicated between them. These problems are compounded as new dimensions to the crisis manifest, such as the proliferation of fentanyl.

For data-driven initiatives to work, uniform data standards needed to be implemented and enforced. And while an overhaul of the existing American data regulation system is beyond the scope of this article, coordination between existing systems will be necessary for data-driven initiatives to succeed.

C. Data Sharing

The issue of "siloing" of data is also related to existing problems with data sharing. First, as noted, potentially relevant data is held in different databases that are not connected, preventing the data from being analyzed together. Second, agencies that may be in the best position to respond only have one piece of the puzzle — the data they themselves hold — and are therefore unable to approach the crisis from a wide enough angle. The fact that data is held in both public health and law enforcement sources creates difficulties when agencies seek to share information across such categories.

The CDC defines data sharing as "[g]ranting certain individuals or organizations access to data that contain personally identifiable information …"[73] To be sure, not all data related to the opioid crisis necessarily contains personally identifiable information, and indeed, many examples of data sharing initiatives do not use personally identifiable information at all. But not only are there issues with data sharing within each category, e.g., between hospitals and public health agencies, there are additional issues with data sharing across categories, e.g., between public health agencies and police departments. Thus, agencies must be able to either share data with each other or contribute to a central data repository to which each agency has access.

Again, the call for coordination between public health agencies and law enforcement is not new—particularly in the pandemic or bioterrorism context.[74] Here, however, the situation is not wholly health-related, differentiating it from the opioid crisis context, which calls on data from both health *and* law enforcement sources, and thus potentially requires the involvement of a larger number of actors. Further, public health or syndromic surveillance systems developed for bioterrorist threats often concern cooperation for the purposes of prosecution. While criminal justice solutions, such as arrests and prosecutions of drug traffickers and prescribers, are being used by some areas of law enforcement,[75] this article is concerned with data sharing for non-prosecutorial reasons. Thus, other considerations must be made.

Lack of coordination presents additional difficulties for data sharing.[76] Researchers working within New York City public health agencies have noted that "state and local laws that authorize the collection of data may actually impede the ability of health departments to share, analyze, and make use of data across separate disease programs."[77] The researchers explained the genesis of some of the major barriers to data sharing:

> Laws and regulations for reporting and disclosing case information came into existence at different times, driven by specific needs, such as the recognition of a new public health problem. Data confidentiality was addressed in different ways, depending on the prevailing standards at the time and the need to collect and use specific disease information. The result is an array of diverse laws regarding access to confidential information and its subsequent use, a patchwork of legal authority that does not necessarily reflect how the health department needs to operate to fulfill its broad mission of protecting public health.[78]

This situation described here applies not only to New York City, but is replicated across the country. Thus, city, state, and federal health codes will need to be examined to determine how they interact with each other and how they pose barriers to data sharing.

The phenomenon of information blocking also hampers data sharing. Information blocking "occur[s] when persons or entities knowingly and unreasonably interfere with the exchange or use of electronic health

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information."[79] A 2015 report found a "substantial body of complaints and other anecdotal evidence" of information blocking.[80] Complaints directed at healthcare providers also allege that "privacy and security laws are cited in circumstances in which they do not in fact impose restrictions."[81] Information blocking therefore demonstrates the existence of social barriers preventing data sharing. It also indicates a need for educational efforts to inform data holders of what legal obligations they have. Establishing clear, uniform standards and expectations may assist in preventing barriers like information blocking.

Such barriers may also be overcome with the designation of a "lead" agency that is ultimately responsible for collecting data from other agencies. While the "lead" agency would take on additional costs as the central repository, having a designated central source a) may make data sharing easier and more streamlined, b) may help to solve collective action problems, and c) could provide useful models as it is replicated across agencies.

For example, Connecticut publishes a dataset — downloadable by the public and available in a visualization format through graphs and maps[82] — of each accidental death associated with an overdose and contains information on the victim's demographics, cause of death, substance detected, and the manner of death.[83] The data is provided from investigations by the Office of the Chief Medical Examiner.[84] The data, however, is published not by the Office, but rather through Connecticut's Open Data Portal, which was launched by an executive order in 2014.[85] That executive order also established a state Chief Data Officer.[86] In this example, the Chief Data Officer and the Open Data Portal serve as the lead agency, while agencies like the Chief Medical Examiner are cooperating agencies. Such a system may help overcome barriers to data sharing, although this method does depend on the cooperation of state agencies.

Of course, the designation of a "lead" agency is only one potential solution. Further, the "lead" agency model serves mainly to address logistical issues in developing data-driven initiatives. There are further issues, such as legal barriers to data sharing that must be addressed. "Lead" agencies could take the lead on identifying and dealing with these barriers, although removing them will likely require coordination with state legislatures as well.

D. Benefits from Improved Data Collection and Sharing

Some have already noted the potential benefits of improved data collection and sharing.[87] Consider, for example, the use of emergency medical services (EMS) data. One article notes that EMS naloxone administration data was used to observe trends on a population-wide basis, "such as increased use [of opioids] in the summer, weekends, and late afternoon."[88] Another study acknowledges that "EMS records may include objective indicators of opioid involvement; information about circumstances of overdoses, including time; medical care provided; and characteristics of persons who overdose ..."[89] Indeed, EMS data has been used as proxies for suspected overdoses by researchers.[90]

Cincinnati's Heroin Tracker[91] is instructive in combining publicly available EMS data and visualization tools. It maps overdose incidents neighborhood-by-neighborhood, as well as month-by-month and day-by-day. The tracker is updated daily and allows users to search for incidents down to the individual street.[92] It has helped Cincinnati see "trends and 'geographic hotspots,' helping public safety identify key areas for strategically deploying personnel and medical resources."[93] The Heroin Tracker has reportedly enabled Cincinnati to "strategically deploy roving medic units to [high usage locations] ..." with the intention of directing increased resources to specific areas in order to be better positioned to respond to overdoses.[94] For example, say the Heroin Tracker identifies a public park as a "hotspot," particularly on summer weekends. Officials could use this insight to deploy more patrols or EMS teams to that area during those times, or to increase access to Naloxone in that area. If the Heroin Tracker achieves its intended aim, Cincinnati should see less overdoses in the identified areas over time. According to Cincinnati's Chief Data Officer, Brandon Crowley, this is already happening: "Every day, dozens of public-safety and health-department hospitals ... check the Heroin Tracker. It helps them plan more targeted patrols in neighborhoods with the most serious overdoses hotspots and anticipate overdose spikes based on previous trends."[95] And because both the Heroin Tracker and the underlying datasets are publicly available, Cincinnati-area nonprofits and charities can also use the data.[96]

As another example, improved data collection and sharing can help identify "outbreaks" of substances laced with fentanyl. In June 2016, the Yale-New Haven Hospital in Connecticut faced twelve overdoses in less than eight hours after a white powder sold as cocaine — and later identified to have been laced with fentanyl — hit the streets.[97] A coordinated effort between the Office of Emergency Management, Department of Public Health, DEA, local police, Connecticut Poison Control, and Mayor's Office led to immediate action as information came in about the outbreak in real time. Such action included advice to EMS crews to increase the dose of Naloxone for suspected overdoses and

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https://doi.org/10.1177/1073110518782953 Published online by Cambridge University Press

health alerts warning the public that "a high potency opioid marketed as cocaine [was] causing deaths in the region."[98] This coordination may have helped "to confine the outbreak, save patient lives where possible, alert the public, and gather additional information."[99]

Efforts like those in Cincinnati and New Haven are certainly promising, although it is unclear whether such a project could be implemented on a larger scale. The Heroin Tracker is an example of how relevant actors' interests must align, along with institutional support from the government, for new initiatives to develop and thrive. Nevertheless, it does demonstrate a new way of using data visualization tools. Other cities have followed suit with either similar maps, such as Seattle's overdose "heat map,"[100] or by publicly publishing datasets, like the Northampton Massachusetts Police Department.[101] These efforts indicate the potential for the implementation of local and publicly available overdose trackers and datasets.

But Cincinnati's Heroin Tracker relies on only one source of data: emergency response data. Thus, while it may be instructive from a data collection standpoint, it may not necessarily be useful from a data *sharing* standpoint. Moreover, EMS data and records are not the only useful information available.

Maryland's efforts illustrate this point. In June 2014, Governor Martin O'Malley issued an executive order establishing an Overdose Prevention Council, consisting of the Department of Health and Mental Hygiene, the Department of State Police, the Department of Public Safety and Correctional Services, the Department of Juvenile Services, and the Institute for Emergency Medical Services Systems.[102] As part of the Council, the agencies are to "seek opportunities to share data with one another . . .."[103] The executive order, however, provided no guidance on how to share data, for what purpose, or how to deal with state data sharing regulations.

The Council sought to overcome these difficulties through a six-step method: "identify available data, set priorities, identify a lead agency, address legal concerns, draft memoranda of understanding (MOUs), and share data."[104] Using this method, the Council prioritized identified sets of data for "matching," such as matching overdose records with "prior hospitalizations and emergency department visits for overdose ..."[105] The Council also determined that data privacy and confidentiality laws would "not prohibit data sharing if the data were exchanged in the limited manner as proposed by the Council, and with appropriate MOUs in place."[106] For example, the Council concluded that overdose registry data that originated from autopsy records was not in violation of privacy laws.[107] The Council also worked with attorneys to draft MOUs that outlined responsibilities for data use and data security and confidentiality between the agencies.[108] The resulting matches were received by the Department of Health and Mental Hygiene, who found that analyses using the data resulted in "important insights and policy initiatives."[109] Maryland's efforts demonstrate a potential success in matching and sharing datasets, and its use of MOUs to address privacy and security concerns may prove instructive.

The Cincinnati, New Haven, and Maryland examples also gesture towards other, more theoretical ways in which improved data sharing and collection could be used in public health surveillance systems. For instance, if matching datasets from disparate agencies can help identify particularly vulnerable populations in a city — whether demographically, by location, etc. — it may help policymakers or researchers design programs to reach those populations, such as clinics, treatment services, information campaigns, or increased deployment of naloxone. Maryland has already implemented this to some extent. Insights derived from Maryland's efforts to match datasets found that individuals recently released from correctional facilities were at a higher risk of overdose immediately following release compared to periods of time three months to a year later.[110] This insight had an immediate impact on policy, as the state corrections agency "became a leading partner in distributing information on overdose prevention and treatment programs to inmates at the time of release," and is currently exploring the possibility of providing vulnerable individuals with naloxone upon release.[111]

Additionally, public health and syndromic surveillance systems may also help predict patterns or trends. Some researchers have already pointed to this possibility by looking at past datasets and known fentanyl outbreaks to determine whether a real-time analysis of data leading up to the outbreak would have helped predict it. One study, for instance, used a five-year dataset of calls made to the Illinois Poison Center and conducted a prospective analysis to "determine when [a 2006 Illinois fentanyl] outbreak would have been identified if the data were being analyzed in real time."[112] The study found that the outbreak would have been identified one month before the first reports were made to the CDC.[113] The ability to predict or track particularly potent batches of heroin could help both law enforcement and hospitals contain and respond to overdoses.

Improved data collection and sharing may also help to identify who may be at risk for developing substance use disorders in order to target them for treatment, such as medically assisted treatment or counseling. Such screening tools have been tested in the past.

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For example, one study used certain behaviors and risk factors, such as requests for early refills, the type of pain involved, or resistance to therapy changes or alternative therapy, as part of a screening tool to identify which patients were at a higher risk of abusing opioids.[114] Another study applied identified risk factors, such as medical, family, and social history, to health insurance claims data, enrollment data, and PDMP data as part of a risk analysis to identify patients that may be at risk of developing a substance use disorder.[115] A third found, in looking at the electronic health records of patients admitted to hospitals for an overdose, that healthcare costs for a patient "often spike just before an overdose."[116] Such tools, if implemented more widely, and using data from different sources, such as a patient's medical history, the state PDMP, and insurance claims data, could help physicians identify which of their patients may be at risk of developing a substance use disorder and to adjust monitoring systems or treatment plans accordingly.

be used to make treatment policy decisions on a more general level. For example, the Healthcare Fraud Prevention Partnership proposed using their cross-payer data to "develop and implement data monitoring algorithms to identify geographic locations or payer networks with comparative shortages of MAT providers and/or MAT utilization."[117] These kinds of efforts could help officials ensure that treatment options are reaching the neediest populations.

Other benefits may accrue from improved data sharing, many of them practical in nature. For instance, the centralization of data may be useful, if only to "minimize [requests for information] among numerous data sources."[118] Data sharing may also help address issues with underreporting. It may also have direct impacts on the opioid crisis by identifying excessive opioid prescribing and doctor shopping for more targeted investigations by law enforcement.[119]

Finally, simply having more data collected and shared about the opioid crisis may help forge the

Of course, it will be difficult to measure the impact of sharing data and policy changes immediately, and it is difficult to assess the effectiveness of currently-implemented data sharing initiatives. Some metrics are easy to measure. For instance, if Cincinnati's Heroin Tracker is effective, we should see less overdoses. But other success criteria are less clear. At this stage, many of these benefits are merely hypothetical. It is important to note that data sharing initiatives are not cheap and bring not only monetary costs in their implementation, but also in the redirection of resources. Further, not all data sharing initiatives are created equal. Some may cost far more than they benefit. Thus, a cost-benefit analysis is a key concern and must be a critical piece of any campaign for improved data sharing and collection.

It is also possible that improved data collection and sharing could help individuals with substance use disorders already undergoing treatment. Better aggregation and analysis of data on a population-wide scale, or within specific populations or communities, could help researchers identify which types of treatment help particular individuals. For example, integrating both healthcare data and law enforcement data for incarcerated individuals with substance use disorders could help identify risks for that specific population, determine whether their unique needs are being met, evaluate whether existing treatment programs are adequate, and reveal insights into what treatment may work best for them. Similarly, data analysis could

political will necessary to act. A lack of political will may very well be a barrier to implementing important policies. Understanding the human and economic impact of the opioid crisis may either spur political actors to act on their own initiative or give the public the ammunition necessary to put pressure on public officials themselves.

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III. A Regulatory and Legislative Approach

After having identified existing issues with data collection and sharing, this article now turns to examining the regulatory framework that may contribute to those issues. This section first provides a brief overview of statutes and regulations that bear on data sharing between states and among state agencies in the context of the opioid crisis, turning first to federal and then state laws. It then discusses a few existing proposals and makes suggestions for how laws and regulations can aid data sharing initiatives. Finally, the article considers a few key objections.

A. Current Federal Regulations

As discussed, there are no comprehensive federal regulations governing the collection of data. Instead, there is a sectoral framework, coupled with a system of rules and guidelines issued by different governmental agencies. This complex web of legislation and regulation contributes to difficulties in determining what kind of information can be collected and shared.

The major piece of federal legislation at issue is the Privacy Rule of the Health Insurance Portability and Accountability Act (HIPAA). HIPAA applies to protected health information.[120] Such information may not be disclosed by a covered entity[121] without valid authorization.[122] HIPAA does permit disclosure by a covered entity to "[a] public health authority that is authorized by law to collect or receive such information for the purpose of preventing or controlling disease, injury, or disability."[123] Another provision of HIPAA also permits a covered entity to disclose protected health information if it "in good faith, believes the use or disclosure: [i]s necessary to prevent or lessen a serious and imminent threat to the health or safety of a person or the public; and [i]s to a person or person reasonably able to prevent or lessen the threat."[124]

One regulation for the records of patients with substance use disorders, 42 C.F.R. Part 2, "prohibit[s] the disclosure and use of patient records unless certain circumstances exist."[125] Patients can sign consent forms allowing disclosure, but such consent can also be revoked.[126] The regulation contains exceptions for notification to medical personnel in an emergency or to law enforcement if there is an immediate threat to the health or safety of an individual, but these exceptions are limited.[127] While some have praised 42 C.F.R. Part 2 for its protection of individuals with substance use disorders before HIPAA existed, it may now impede the delivery of quality medical care to those same individuals.[128]

Thus, data protections concerning the sharing of identifying protected health information, on the federal level may prevent extensive use of such information in public health or syndromic surveillance systems. However, it may be possible to use *de-identified* information. HIPAA's Privacy Rule "permits a covered entity or its business associate to create information that is not individual identifiable by following the de-identification standard and implementation specifications in § 164.514(a)-(b)."[129] Covered health entities have two options to create de-identified data: "1) a formal determination by a qualified expert; or 2) the removal of specified individual identifiers as well as absence of actual knowledge by the covered entity that the remaining information could be used alone or in combination with other information to identify the individual."[130] De-identification could therefore both address privacy concerns and provide a means to share protected health information.

But regulations concerning protected health information are only one side of the story. Many of the public health or syndromic surveillance systems currently used rely on emergency response data. *Public* health data can also be matched with emergency response data. Many of the systems discussed do not rely on protected health information, although arguments could certainly be made that access to such information would provide more targeted responses. Further, sharing protected health information may be more productive in combating the opioid crisis long-term, rather than addressing short-term objectives and goals, such as where to direct emergency resources for overdoses. Still, while existing regulations initially appear to be a barrier, multiple sources of data exist that can be harnessed effectively.

B. Current State Regulations

State regulations regarding health information differ both in their attempts to conform to HIPAA and their own regulatory schemes.[131] On a state level, public health agencies are sometimes exempt from patient consent and authorization for data "used in the course of fulfilling public health functions."[132] Further, state governors may have emergency powers to issue "orders that mandate reporting of health information needed to respond to a public health threat."[133] Certain states

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also permit health care providers to send clinical information to public health agencies for "studies that address a wide range of public health concerns ..."[134] When it comes to emergency response data, many departments are *permitted* to report information to state public health agencies, while some states actually *require* hospital emergency departments to report.[135] Ultimately, many of the issues discussed in the previous section replicate themselves on the state level; albeit in a more complicated fashion given the multitude of actors involved.

PDMPs illustrate differences between states in how data-based programs operate. For instance, states differ in how long PDMP data can be retained.[136] Arkansas, for instance, requires that data be maintained for three years,[137] while Pennsylvania allows for the removal of patient identifying information that is more than seven years old, along with complicated rules for extensions in the event of requests made by law enforcement or licensing boards.[138] Other states do not appear to have statutory data retention timelines.[139]

Similarly, states differ when it comes to authorized users and the conditions of access.[140] Colorado requires users to sign a written agreement that "ensures compliance" with the statute.[141] Oklahoma, on the other hand, describes the disclosure of certain statistical information that is *not* prevented.[142] Other states have different standards for disclosure to authorized users.[143]

Finally, states differ in how their statutes approach interstate sharing of PDMP data.[144] Connecticut, for example, permits it for the purposes of licensing or criminal investigations.[145] States differ between what agencies or officials in other states may receive information from PDMPs, with certain caveats, such as data use agreements.[146] These issues with PDMPs illuminate many of the problems that arise when states have their own data sharing regulations.

Although a full survey of both federal and state data sharing laws is beyond the scope of this article, these differences exist and must be addressed if state public health and syndromic surveillance systems are to coordinate. Data-sharing initiatives on both a state and federal level will have to carefully consider the existing legislative and regulatory environment to ensure that their programs are effective while still complying with the law.

C. Legislative Proposals

This article has thus far discussed existing barriers to data sharing and collection and highlighted a few key examples of current data sharing initiatives used in combating the opioid crisis. It also discussed potential benefits that may result from existing initiatives, as well as other ways in which data could be used to yield important insights. The article now turns to existing calls for reform and makes a few recommendations for the relevant actors to keep in mind. Finally, the article considers objections to improved data collection and sharing — such as privacy interests, data security, and the potential cost of data sharing initiatives.

Some states and policy groups have already recognized that there are existing issues with data collection and sharing, and several have called for changes in the data sharing regulations as a method of combating the opioid crisis. The National Governor's Association recommended the establishment of a "collaborative information sharing environment that breaks down silos across state agencies,"[147] while the Safe States Alliance called for states to "establish and enhance capacity to conduct opioid drug overdose surveillance and prescription opioid monitoring" and for local public health agencies to "[a]ccess and use multiple sources of data and tools to monitor and describe the opioid overdose epidemic."[148] Meanwhile, Washington passed a bill in 2017 in which the legislature found that "public health data is critical to the [D]epartment [of Health]'s ability to respond to emerging health threats."[149]

Further, some states have already made efforts to improve data collection and sharing. In April 2017, West Virginia passed a bill creating an Office of Drug Control Policy.[150] It requires the Office to "[m]onitor, coordinate and oversee the collection of data and issues related to drug [] access [and] substance use disorder policies," to encourage coordination among agencies, organizations, and service providers, and to "[d]evelop and implement a program ... to collect data on fatal and nonfatal drug overdoses" from different agencies.[151] The Office is also required to establish and maintain a "central repository"[152] that contains a wide range of information that pharmacies, health care providers, medical examiners, emergency response providers, and law enforcement agencies are required to report, including "emergency medical or law-enforcement response[s] to a suspected or reported overdose ... [m]edical treatment for an overdose; [t]he dispensation or provision of an opioid antagonist; and [d]eath attributed to overdose or 'drug poisoning.'"[153]

Such systems also have the potential to be useful between states and in conjunction with federal agencies. Already, policymakers have called for greater interstate data sharing efforts. The President's Commission on Combating Drug Addiction and the Opioid Crisis called on President Trump to "[p]rovide federal funding and technical support to states to enhance interstate data sharing among state-based prescription

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drug monitoring programs" and to "[e]nsure federal health care systems ... participate in state-based data sharing."[154] Additionally, some states have attempted to share data across state borders, particularly with data collected by PDMPs. Federal policymakers and legislators should devise plans to encourage the implementation of such systems and to facilitate sharing between them, while keeping in mind important concerns regarding privacy and security.

There may be benefits to focusing new data sharing efforts on the federal — rather than state — level. Federal agencies may have more funding or be better situated to respond to nationwide issues, as opposed to the local responses of cities and states. Further, aggregating data nationwide will allow for broader analyses of the opioid crisis. Involving the federal government can also provide incentives for states to cooperate in interstate data sharing. Implementing public health and syndromic surveillance systems on a nationwide level may also help in creating uniform data standards, protecting privacy interests, and securing data from breaches. Finally, federal agencies may find it easier to coordinate data sharing between states, rather than relying on individual states to broker data sharing agreements. Thus, federal agencies and policymakers are a key component of using data to fight the opioid crisis.

What models of public health or syndromic surveillance should be used? The West Virginia example, as well as the Maryland example discussed earlier, may prove instructive for future data sharing initiatives on both the state and federal level. Both examples involve the designation of a "lead agency" that acts as a central repository for the collection of data relating to the opioid crisis. The Maryland Council's six step method could be implemented across state and federal governments to assist agencies in deriving meaningful analysis through the "matching" of different datasets. And along with the identification of a lead agency for a central repository, state and federal governments must implement data standardization procedures for collection among their various agencies to ensure that any data collected can be used effectively. They must refine and implement de-identification procedures for any patient protected health information. HIPAA's Privacy Rule, as well as guidance from government agencies, can be helpful here. However, as noted earlier, there are a few potential obstacles to sharing data between states and the federal government. Moreover, implementing public health and syndromic surveillance systems on a nationwide level will require the alignment of political interests and actors, which may prove difficult in the current political climate.

Still, this article ultimately argues that there are important potential benefits to improved and increased data collection and sharing as well as the development of new data sharing initiatives as tools to combat the opioid crisis. State and federal officials should carefully examine their existing datasets and sources, devise new standards for data collection and the format it is stored in, explore ways of creating central data repositories, and identify existing barriers to sharing data across and between local, state, and federal agencies.

Still, this article ultimately argues that there are important potential benefits to improved and increased data collection and sharing as well as the development of new data sharing initiatives as tools to combat the opioid crisis. State and federal officials should carefully examine their existing datasets and sources, devise new standards for data collection and the format it is stored in, explore ways of creating central data repositories, and identify existing barriers to sharing data across and between local, state, and federal agencies. The sheer human and economic cost of the opioid crisis necessitates assurance that the correct data is being collected so that we can truly understand the scope of the opioid crisis and be better positioned to respond. The individual efforts by cities and states discussed throughout this article are positive indicators of the potential role data sharing initiatives could play in combating the opioid crisis and should signify to policymakers the importance of ensuring they can work effectively.

D. Potential Objections

This section briefly addresses objections to expanding data collection, sharing, and analysis. Although devising thorough solutions to these problems are beyond the scope of this article, considerations and awareness of these problems are important for policymakers seeking to improve data collection and sharing and to implement data sharing initiatives.

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i) Privacy Interests and Increased Government Surveillance

Perhaps the key objection to expanded data collection and sharing are privacy concerns. This is true especially in the context considered here. Privacy concerns have long contributed to healthcare data's long history of exceptionalism in American law, as demonstrated by specific statutes and regulations governing the privacy of healthcare data.[155] Indeed, recent legislation demonstrates ongoing privacy concerns with the opioid crisis. For example, Senate Bill 581, also known as Jessie's Law, requires the HHS Secretary to work to:

> identify or facilitate the development of best practices regarding … the circumstances under which information that a patient has provided to a health care provider regarding such patient's history of opioid use disorder should, only at the patient's request, be prominently displayed in the medical records (including electronic health records) of such patient … [and] the process and methods by which the information should be so displayed.[156]

However, there are potential solutions that respect individual privacy while also facilitating data collection and sharing. As noted, HIPAA permits the disclosure of de-identified protected health information under two methods: a) if an individual with "appropriate knowledge of and experience with generally accepted statistical and scientific principles and methods for rendering information not individually identifiable" determines that the risk of re-identification is "very small" and documents the analysis underlying that determination, or b) if eighteen pieces of individually-identifying information, including names, medical record numbers, IP address numbers, and biometric identifiers, have been removed.[157] De-identification, if successful, provides a possible answer to privacy concerns.

Moreover, de-identified data can still be used in generating meaningful analysis. Cincinnati's Heroin Tracker, for instance, does not rely on personally-identifiable information, nor do many other systems relying on emergency response data. More general information about the opioid crisis held by public health agencies could also be used. At the same time, in view of the stigma associated with substance use disorder,[158] a balance must be struck between access to data to benefit the public health and individual health data privacy concerns.

A set of related issues concerns the level of government surveillance accompanying increased data collection and sharing. While much of the dialogue in recent years concerns data collection by agencies like the NSA or by large corporations, mass government collection of health data and law enforcement data relating to drug use may pose similar concerns for privacy advocates. And though the government often justifies data collection and surveillance by agencies like the NSA with national security interests, those same concerns do not apply in this context. Thus, Americans may be less willing for the government, both state and federal, to engage in data collection and sharing when it comes to health and law enforcement information.

One potential solution to both privacy concerns and the fear of government surveillance is to push for the transparency of data use. One white paper from the American Medical Informatics Association recommended "[i]ncreas[ing] transparency of data use and promot[ing] public awareness," including the benefits and problems with the secondary use of health data.[159] Many of the examples of systems discussed in this paper already follow open data principles, including publishing their datasets and methodology, and permitting public access online to their data portals and visualization tools. Further open discussion of the rationale behind data collection, as well as its costs and benefits, may convince concerned parties of the need to collect and share information, particularly if it is not personally identifiable.

Additionally, because the opioid crisis intersects with some degree of illegal activity, individuals may be concerned about possible criminal repercussions from increased data sharing and collection. As noted earlier, the DEA has already subpoenaed at least two state PDMPs for information relating to criminal investigations. There is the concern for potential "fishing expeditions" by law enforcement into the data collected by different state and federal agencies.

Finally, individuals with opioid use disorders may be discouraged from speaking to certain government agencies out of fear that their information will be accessed and used by other agencies. This could have a chilling effect on cooperation between individuals affected by the opioid crisis and the government, which could, in turn, have disastrous effects down the line. States seeking to implement public health and syndromic surveillance systems therefore have many serious privacy concerns to consider.

ii) Potential Hacking/Unauthorized Access to Data

As with any major data collection and sharing system, the potential for hacking or stealing of information exists here as well. In a 2016 poll, about half of Americans were concerned about unauthorized access to their information.[160] And already, there are concerns about potential hacking of data with regards to

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https://doi.org/10.1177/1073110518782953 Published online by Cambridge University Press

the opioid crisis and PDMPs in particular.[161] Certainly, there is additional concern because data connecting individuals to the use of illegal drugs may have criminal consequences, let alone other privacy interests individuals may have in their medical data as well as the dignitary interests they have in such data remaining private and out of the hands of unauthorized users.

Outside of the opioid crisis context, there have already been proposals for cybersecurity risk management.[162] Additionally, existing federal regulations contain provisions requiring entities to provide notice of breaches of protected health information.[163] Some states have their own security breach notification laws that require that individuals who hold data containing personal information disclose any breach of the security system.[164] Others have regulations that describe various security protocols that affected companies must implement into their security systems.[165] Memorandums of Understanding and Data-Use Agreements could also be useful. They can be used to carefully outline the scope and purposes of data usage. They may also prescribe penalties for violations or misuse of data, although such penalties may not be sufficient to prevent misuse on their own, and enforcement of such penalties may prove difficult.

To address concerns about security and unauthorized use of data, agencies seeking to implement public health and syndromic surveillance systems relating to the opioid crisis must seriously consider and devise methods to meet such concerns. Such systems should not be used until security concerns have been addressed and protocols are in place to protect data.

iii) Costs of the System versus Benefits

A final objection is the concern that the benefits of implementing data collection and sharing programs will not outweigh the costs. Certainly, implementing public health and syndromic surveillance systems will carry with them many costs: the costs associated with writing and passing legislation, creating, and refining data collection systems, pursuing different data visualization tools, dedicating personnel to managing these systems, and the sheer amount of time involved, as just a few examples. The CDC and other government agencies have used funding and grant programs to encourage the use of technology and data in the public health sphere. But funding and grants in these programs are awarded on a proposal-by-proposal basis, and certainly cannot, on their own, fund an entire nationwide system. Individual states will likely have to earmark funds in addition to seeking funding from federal agencies like the CDC.

There are also costs beyond merely funding data sharing initiatives. For instance, these initiatives may require the redirection of resources — such as money, time, and personnel — from dealing with other aspects of the opioid crisis. Put simply, every emergency personnel assigned to collect and track data on a database means one less person in the field. Data sharing initiatives also require officials to bring on a variety of subject-matter experts — not only to create these systems, but also to maintain them, to update them, to analyze the data, to design policies based on the data, to evaluate those policies once implemented, and to deal with legal issues raised by these systems. They also result in "bandwidth costs" as officials are forced to relearn and continually interact with newly de-siloed systems of data and to respond to requests for the data from other agencies, as well as researchers and outside policymakers.

Further, benefits from using public health and syndromic surveillance systems may not accrue in the ways we expect. One possibility is that such systems result in "data fatigue," with the result that data is ultimately not used in a meaningful matter. The collection of data may mask other flaws in our current response to the opioid crisis and may merely act as a "band aid" on the crisis. After all, merely collecting, storing, and processing data on its own does not lead to any solutions. Thus, potential benefits do not manifest unless the data is actually used, which again carries with it significant costs.

One potential solution is to continue to encourage city and state-based experiments into using public health and syndromic surveillance systems. These individual experiments, such as Cincinnati's Heroin Tracker, can provide a guide for future versions of such systems, and allow room for refining them in order to minimize costs and maximize benefits. Once individual experiments prove successful, they can be replicated in other cities and states. However, this solution is slow to implement, and may have costs in terms of the lives lost as the opioid crisis continues. Further, it may create a patchwork system of public health and surveillance systems, leading to issues of standardization between states and the ability to share information.

Ultimately, any potential data sharing initiative, or reforms for improved data sharing and collection, must undergo a cost-benefit analysis to ensure that the initiative is actually a net benefit in combating the opioid crisis. Data sharing alone is not — and should not — be seen as a silver bullet in dealing with the opioid crisis, as many data sharing initiatives are *not* worth the added cost. Any potential attempt at reform must proceed with caution to ensure that their efforts do not tax an already-overburdened system.

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IV. Conclusion

Despite numerous challenges, implementing public health and syndromic surveillance-like systems may prove useful in combating the opioid crisis. Researchers and policymakers have lamented the lack of accurate data and the fear of underestimation of the opioid crisis. And already, experiments by individual cities and states have produced meaningful analysis and information that have led to policy changes in the deployment of valuable resources. Public health surveillance systems — aggregating the collection of data, matching important datasets, and deriving key points of analysis — may assist policymakers and researchers better understand the scope of the crisis, and implement new policies designed to effectively respond. It could help public officials better identify where and when overdoses are likely to occur in order to save lives by improving the deployment of resources like emergency services and Naloxone or to reveal likely "pill mills" of over-prescribers for more targeted investigations. It could help physicians identify which of their patients may be at risk of developing a substance use disorder and revise their treatment plan, and help public officials identify vulnerable demographics or populations for more serious interventions.

There are a few potential obstacles to using such systems on a wide scale — among them legal, economic, and privacy concerns. However, the potential benefits of these systems may provide the impetus for their development. As cities and states like Cincinnati and Maryland continue to refine and act based on their data analysis, we will begin to see whether the more sophisticated use of data may help combat the opioid crisis.

Note

The authors have no conflicts to disclose.

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