



ISSUE BRIEF

THE BENEFITS OF USING GIS TECHNOLOGY IN STATE SUBSTANCE USE AGENCIES

SEPTEMBER 2019

INTRODUCTION

State substance use agencies are increasingly turning to Geographic Information System (GIS) technology or other data visualization tools to support their activities. GIS has many applications and is used in numerous fields: environmental planning, disaster management, law enforcement, and health, among others.¹ Within the health sector, GIS has been used most notably for epidemiology and public health monitoring. Cancer surveillance programs, for example, map clusters of cancer cases to assess their relationships to selected risk factors (e.g., poverty, lack of insurance, race/ethnicity) and their proximity to potential environmental causes. The public health sector also uses GIS to help identify where individuals are at risk for certain health conditions and where the incidence of specific diseases is high. Health professionals are then able to target prevention strategies and health care services to improve the population's health and save lives.



Use of GIS in public health has its roots in medical geography, which originated in the fifth century BC when Greek physician Hippocrates documented a relationship between health and the environment.^{2,3} Much later, Dr. John Snow, considered the father of modern epidemiology, used spatial data to prove the water-borne origin of cholera. He mapped cases of cholera and cholera-related deaths in London in 1854 along with the location of the city's water pumps, showing that the concentration of cholera cases was highest in the homes closest to the Broad Street pump.⁴ Dr. Snow's analysis turned out to be life-saving, and from then on, mapping and spatial analysis have been important problem-solving tools for public health.

The Canada Geographic Information System, developed in the 1960s by Roger Tomlinson for Canada's Department of Forestry and Rural Development, is widely considered the first computer-based GIS.⁵ Its purpose was to map the country's land resources. Advancements in computer and mapping technology and the development of statistical packages since that time have made modern GIS possible. GIS applications in the health sector are further supported by the ever-expanding collection of health and socio-economic data linked to geographic areas (e.g., home addresses, ZIP codes, school districts). Vast amounts of data collected through state and federally-sponsored surveys and patient data available in electronic health records provide opportunities to analyze spatial data and information. Layering of data from multiple data sources on maps can reveal important relationships, such as those between risk factors, health behaviors, and health outcomes. GIS analyses of these data also can expose incidence or prevalence of health conditions in certain communities, health disparities, service utilization issues, and resource shortages.

The severity and complexities of substance use problems within states and across the country are placing significant demands on policymakers and health professionals to find solutions. As an example, practical strategies to reduce the number of opioid-related overdoses and deaths continue to be a pressing need. Expansion of treatment and recovery support services to meet community demands is another critical need. GIS is a powerful analytical tool that helps policymakers, program managers, and staff visualize, question, analyze, interpret, and understand substance use data in new ways and then find innovative solutions.

In January 2019, the National Association of State Alcohol and Drug Abuse Directors (NASADAD) sent a short, online inquiry to state substance use leadership, asking about their agencies' use of GIS. The inquiry yielded 35 state responses; the majority of the states responded that they were using GIS in some capacity. Some reported their agency had used GIS for more than a decade, while others said they have been using it for less than a year. Respondents noted benefits including improving their

state's ability to identify emerging substance misuse patterns and trends, increasing public awareness of the opioid crisis and other substance use problems, and informing state and local policy and service decisions. States also noted a desire to learn more about the application of GIS in state substance use agencies.

This Issue Brief provides case studies of two states – Washington and Pennsylvania – that are using GIS within their substance use agencies. Each case study provides (1) an overview of the problem the state sought to address with the help of GIS technology, (2) examples of how GIS is currently supporting the state's substance use prevention, treatment, and recovery activities, and (3) the benefits, or impact, of the state's GIS applications. The case studies are meant to inform and inspire other states to consider GIS as a method for data-driven analysis, problem solving, and decision making. Lessons learned from these two states' implementation of GIS follow the case studies.

It should be noted that while these case studies discuss certain proprietary software packages and tools used by Washington and Pennsylvania, many GIS vendors, tools, and software packages exist. The optimal tools for a state will vary depending on such factors as the type of data, users, and project goals. Accordingly, this brief's mention of specific software and products should not be viewed as an endorsement, but reflects the needs and preferences of Washington and Pennsylvania to accomplish their specific projects.



CASE STUDY #1 – Washington State Health Care Authority Division of Behavioral Health and Recovery: Community Prevention and Wellness Initiative and Medication-Assisted Treatment Locator

The Washington State Health Care Authority (HCA) Division of Behavioral Health and Recovery (DBHR) leads state efforts to prevent substance use disorders and provide holistic, evidence-based, person-centered care for individuals with behavioral health conditions.⁶ GIS technology supports these efforts by helping DBHR target mental and

substance use disorder prevention and treatment programs/strategies and connect individuals with substance use disorders to appropriate treatment services.

The Washington State Division of Alcohol and Substance Abuse (DASA), a predecessor agency to DBHR, was an early adopter of GIS, first using the technology in 1993 when the state built a comprehensive database of community risk and protective factors in collaboration with the University of Washington's Social Development Research Group (SDRG). This effort was funded by the Substance Abuse and Mental Health Services Administration (SAMHSA) and was part of the Six-State Consortium for Prevention Needs Assessment Project. Washington's GIS technologies and applications have evolved since then in a number of ways, including being able to produce data and present information at a more disaggregated level (e.g., school district, neighborhood).⁷ These advancements enable behavioral health programs and services to be geographically-targeted and more responsive to neighborhood- or school district-level risk factors and substance use problems.

THE CHALLENGE

Data are essential for identifying prevention and treatment priorities, allocating resources wisely, and implementing programs that can be sustained over the long term with positive health outcomes. In the behavioral health field, data are required at multiple levels – state, county, and community – and by various stakeholders – government officials, school

district personnel, coalitions, health care professionals, families, and individuals. The push to use data for decision making has increased over the last two decades. The reasons for this are many. They include having limited resources and the necessity to deploy them to areas of greatest need and to justify specific program investments in behavioral health strategies to funders, policymakers, and the general public.

From the mid-1990s on, leaders within DASA believed that greater use of data would enable the agency to have a better understanding of community needs, make more prudent decisions about programming, and demonstrate that prevention is effective and treatment works. Moreover, they understood that counties, communities, and coalitions needed data to support their programming decisions and address challenges of their everyday work. The Community Outcomes and Risk Evaluation GIS (CORE-GIS), funded through SAMHSA grants and housed in the State Department of Social and Health Services (DSHS) Research and Data Analysis Division (RDA), produced reports on risk and protective factors for the state as a whole, counties, school districts, and other communities. These data were used in the late 2000s to create a series of maps displaying risk indicators for counties, their school districts, and neighborhood-like areas (ZCTAs).⁸ With over six hundred individual maps created, the series showed areas of high, average, and low risk and need throughout the state. The CORE-GIS drew from over 50 data sources. Stakeholders quickly realized the value of the maps, and this led to a system of reports, including Community Data Books, that support decision making today.

Recently, DBHR also identified the need to improve access to programs offering medication-assisted treatment (MAT) services. This need arose from the increase in opioid use, morbidity, and mortality throughout the state. Between 2002 and 2015, drug-caused deaths involving opioids rose 33 percent statewide, with increases seen in most counties.⁹ Ensuring that individuals and health care providers could locate evidence-based MAT programs was critical to reversing this trend and restoring health for people with an opioid use disorder (OUD).

THE SOLUTION

Over a period of 25 years, DBHR has increasingly used GIS to provide unique insights into available state and national data – patterns, relationships, and trends. GIS applications have enabled DBHR and state and community partners to build custom applications that aid users in making data-informed decisions. Two examples are GIS analyses and maps for the Community Prevention and Wellness Initiative (CPWI) and the Recovery Help Line’s MAT Locator, described below.

Community Prevention and Wellness Initiative

Launched in 2011, the CPWI is an effort to provide substance use prevention services and strategies through local coalitions and school-based services in high-need communities. CPWI provides resources that enable state and county officials, coalitions, and other prevention professionals to use a data-informed, community-level decision making process to target and leverage resources. CPWI implements programs in 82 communities located in all 39 counties and all 9 Educational Service Districts (ESDs).¹⁰

GIS technology is a critical tool for the CPWI. The RDA supports DBHR and the CPWI by compiling detailed Data Books with risk and protective factor indicators for each community. Data sources include the CORE-GIS and the Washington State Healthy Youth Survey (HYS). Data can be overlaid on maps, like in Figure 1. This map, for example, shows the composite risk ranking for alcohol, tobacco, marijuana, and prescription opioid use among 10th grade students in high school attendance areas of the Seattle School District compared to the state, and these data inform decisions about funding allocations. RDA can also create maps for just alcohol or other specific drugs, enabling communities to see where particular substances are problematic. They can then select programs or strategies that address specific risk factors and substances.

DBHR uses the data, which RDA produces annually, in making decisions about which communities to involve in the CPWI, and coalitions use the maps to help determine the most appropriate evidence-based programs to implement. Data Books, risk factor profiles, GIS-generated maps, and other CPWI resources are sent directly to the ESDs and coalitions leading the prevention work. DBHR also shares the maps as broadly as possible, depending on the sensitivity of the data, on Washington's Athena Forum [website](#). Products from CORE-GIS,¹¹ including 454 reports, are available on the RDA [website](#).

MAT Locator

Washington's Recovery Help Line, funded by DBHR, launched the MAT Locator in March 2019 to help people access evidence-based treatment for OUDs. The MAT Locator provides a user-friendly website where individuals can search for providers who offer OUD treatment services. A number of search parameters are available: location (e.g., county, ZIP code), preferred treatment service/medication, desired timeframe for seeking treatment, payment method, age, and services for special populations (e.g., pregnant/parenting women, homeless, Native Americans). The search result is a map (Figure 2) showing available providers. By hovering over each provider "pin" on the map and referencing the list of treatment providers resulting from the search, users can view each provider's name, address, phone number, website, hours of operation, and a brief description of services, along with other details. The primary target audience for the MAT Locator is the general public; however, Help Line staff and other health professionals also use it regularly.

Figure 1. Alcohol, Tobacco, Marijuana and Prescription Opioids Composite Ranking, by High School Attendance Area, Seattle School District, 2018

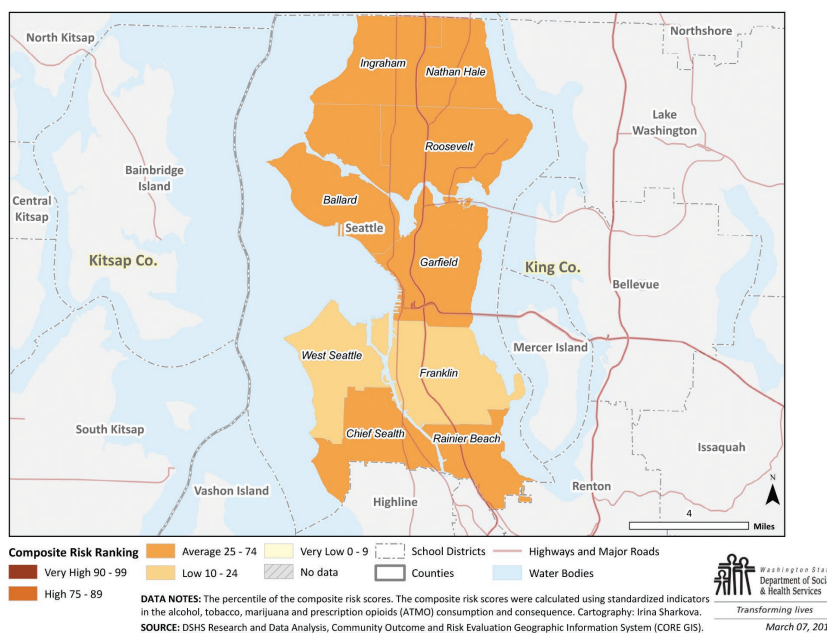
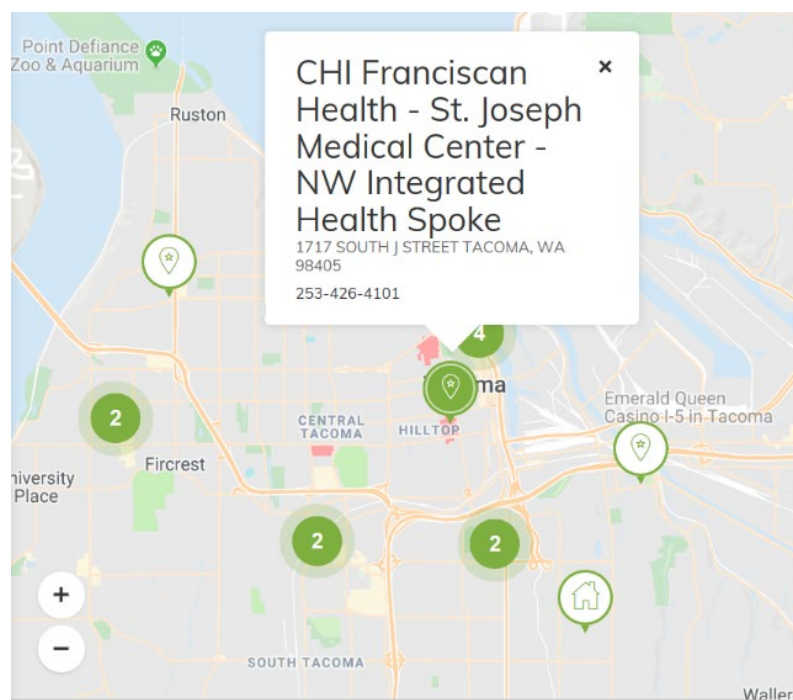


Figure 2. Map from Washington State's MAT Locator



Software

When the state first adopted GIS in the 1990s, it purchased the ArcGIS Enterprise platform and GIS software from [ESRI](#), a leading GIS provider. The software version currently used is ESRI ArcGIS 10.6.1. Considered comprehensive, a variety of sectors and fields use this software, including the defense industry, public safety, environmental planning, and education. Staff within RDA have customized the software to meet the state's needs.

DBHR contracts with a vendor, Care Coordination Systems, for the MAT Locator. They use a map-based platform called [HealthBridge](#) to support the Web-facing portal and store MAT provider data. The map is a custom, Web-based application that utilizes HTML, CSS, JavaScript, and Google Maps. The HealthBridge software offers a user-friendly tool to search for MAT services.

Financing

Multiple funding streams provide financing for Washington's GIS activities in the area of behavioral health. DBHR uses funds from SAMHSA's [Substance Abuse Prevention and Treatment Block Grant](#) (SABG) to contract with RDA for data, maps, and Data Books to support CPWI. SABG funds also finance the Recovery Help Line's MAT Locator. In addition, a portion of the salary of several DBHR, RDA, and Recovery Help Line staff (see next section) supports GIS activities.

Key Partners and Staffing to Support Washington's GIS Projects and Activities

DBHR collaborates with several internal and external entities for its GIS work. RDA staff with GIS expertise continue to support ongoing GIS planning, analysis, and new GIS applications. DBHR also collaborates with the Washington State Epidemiological Outcomes Workgroup (SEOW), which uses population-level data to support prevention planning in substance use and mental health. For the MAT Locator, DBHR contracted with the Washington Recovery Help Line to develop and maintain the Locator, expand their resource database, and create an interactive map of Washington's MAT providers.

Supporting GIS projects and activities for DBHR involves a staff with diverse skills. Within RDA, the GIS team includes a senior geographic research manager, a SAS programmer/statistician, and a GIS developer, who are responsible for the geographic conceptualization, data analysis, programming, and production of reports. RDA collaborates with several staff within DBHR, including a lead research and evaluation manager, a senior policy manager who directs the use of data, and a program manager. At the Recovery Help Line, a full-time database analyst, two full-time MAT Specialists, and part-time assistance from the Program Director support the MAT Locator.

THE IMPACT

Improved Efficiencies in Service Planning

Use of GIS technology in Washington enables DBHR staff to work more collaboratively with community leaders to target substance use prevention and treatment programs/services. GIS gives professionals a tool for analyzing administrative, demographic, risk and protective factors, and other data at multiple levels (e.g., county, ESD) to answer important planning questions such as where to focus limited resources and which programs and strategies to implement based on trends and patterns of substance use.

“Geographic analysis and GIS have allowed the state to focus and target communities with the highest need for prevention and other services. Counties use this information for behavioral health and other health and human services planning where information about communities of high need and less high need is important. This would not have been possible without the state's use of GIS.”

—DSHS RDA staff

Increased Access to Services

GIS technology provides an efficient way for individuals and health professionals to locate MAT services that match an individual's needs and eligibility. Before having the MAT Locator, Recovery Help Line staff and other professionals found it difficult to find current service information for their clients. Now, staff and the general public have an easy way to search for MAT programs. As an example, using the Locator a professional at the Downtown Seattle Needle Exchange was able to obtain an appointment for a client at a MAT program that accepted their insurance and was within an easy commuting distance from their home. The MAT Locator has brought more exposure to the Recovery Help Line, and staff are hopeful that it will make it possible for more individuals to obtain help.

“Putting information in a user-friendly format where people can find their own [treatment] resources is a great benefit and will allow the Recovery Help Line to reach a broader audience.”

—Recovery Help Line staff

Improved Communication

The Locator also helps to facilitate communication between MAT and primary care providers. Moreover, primary care providers who offer MAT are seeing the value in having their clinics' information posted and regularly updated. Regarding CPWI, the spatial presentation of data using maps encourages ongoing communication among state and community leaders about substance use prevention issues.



CASE STUDY #2

Pennsylvania's Opioid Data Dashboard

The Pennsylvania Department of Drug and Alcohol Programs (DDAP), a cabinet-level [agency](#), coordinates and leads initiatives to prevent and reduce drug, alcohol, and gambling addiction and abuse and promote recovery. The goal of these efforts is to reduce the human and economic impact of addiction throughout the state.¹² DDAP coordinates with the Pennsylvania Department of Health (DOH), the state's public health agency, as well as the Pennsylvania Department of Human

Services (DHS), the state's Medicaid agency, for the creation and maintenance of the Pennsylvania Opioid Data Dashboard. The mission of DOH is to promote healthy lifestyles, prevent injury and disease, and assure the safe delivery of quality health care for all Pennsylvania citizens. DHS is responsible for administering services that provide care and support to Pennsylvania's most vulnerable citizens, including management of the Medical Assistance physical and behavioral health care programs.

This case study describes the state's use of maps and data visualization within the context of its Opioid Data Dashboard and highlights two maps: (1) a map of Pennsylvania Drug and Alcohol Treatment Facilities, and (2) a map showing Opioid Seizures and Arrests by Pennsylvania State Police, 2013-2019.

THE CHALLENGE

Prescription opioid misuse and illicit opioid use in Pennsylvania affect all types of communities and people of all ages. From the third quarter of 2016 to the third quarter of 2017, visits to the emergency room due to opioid overdose increased by 80.6 percent.¹³ Pennsylvania had 5,456 fatal drug overdoses in 2017, a 65 percent increase since 2015, and fentanyl and other synthetic opioids were found to be increasingly responsible.¹⁴ The Kaiser Family Foundation's analysis of data from the

Centers for Disease Control and Prevention indicated that the age-adjusted rate of opioid overdose deaths in the state was 21.2 deaths per 100,000 people in 2017, compared to 14.9 deaths per 100,000 people in the United States as a whole. Pennsylvania ranked third in the U.S. for heroin use and seventh for overdose deaths; 47 percent of all drug overdose deaths were attributed to opioids.¹⁵

Statistics such as these led Governor Tom Wolf to sign a 90-day heroin and opioid disaster declaration on January 10, 2018, to focus and intensify the state's response to the opioid epidemic. The declaration outlined initiatives within three areas: (1) enhancing coordination and data collection to bolster the state's and local communities' response; (2) improving tools for families, first responders, and others to save lives; and (3) speeding up and expanding access to treatment.¹⁶ The declaration, which has been renewed six times, directs resources to the state's opioid crisis in a way similar to how resources would be deployed following a natural disaster. With the latest renewal on June 14, 2019, the Governor announced two new initiatives: guidance on naloxone and insurance, and the release of the Opioid Data Dashboard 2.0.¹⁷

THE SOLUTION

All disaster declarations in Pennsylvania activate a command structure. For the heroin and opioid disaster declaration, the state established the Opioid Operational Command Center, led by the Department of Health's Deputy Secretary for Health Preparedness and Community Protection. Initially, 10 agencies were represented in the Command Center; the number has increased to 17 agencies in August 2019 with awareness that the efforts of many agencies from diverse sectors are needed to address the opioid crisis. Secretaries, Deputy Secretaries, policy directors, and others within each agency, including staff from the Governor's Office, participate in the Command Center, and DDAP is a key participant. The Command Center meets weekly to discuss OUD prevention, rescue, and treatment planning and to hear from external organizations about successful programs and strategies.

Opioid Data Dashboard

In March 2018, shortly after the initial disaster declaration, Pennsylvania launched an Opioid Data Dashboard (Dashboard) to communicate with local governments and the general public about the opioid crisis and its effects on the state. The [Dashboard](#) employs data storytelling technology to display a variety of opioid-related data at the state and county levels, as well as resources such as a statewide treatment locator. Maps and charts present metrics for county and state trends over time. As of June 2019, the Dashboard displays data from 50 datasets, collected primarily from agencies represented in the Command Center, and is a resource for government and community leaders as they identify statewide and local opioid problems, find solutions, and share how they are effectively addressing the opioid epidemic.

Pennsylvania's Opioid Data Dashboard is organized into seven sections: Preventing Addiction, Saving Lives, Getting People into Treatment, Get Help Now, Community Impacts, Learn More About Opioids, and View Source Data. The **Preventing Addiction** section provides information on the state's Prescription Drug Monitoring Program and displays county-level data on opioid dispensations and prescriptions, opioid seizures and arrests, and prescription drug take-back locations. The **Saving Lives** section focuses on the availability of naloxone to first responders and the general public. This section provides county-level data and maps showing naloxone administrations by emergency medical services (EMS) providers and trend data related to calls to the Drug and Alcohol Treatment Get Help Now Hotline. The **Getting People into Treatment** section shows the locations and contact information for Drug and Alcohol Treatment Facilities and provides the names and contact information for Single County Authorities which can assist individuals in finding treatment providers. The **Get Help Now** section links users to the Get Help Now Hotline and other important resources for those in crisis. The new **Community Impacts** section highlights the societal impact of opioids, namely their impact on families and children, the economy, the

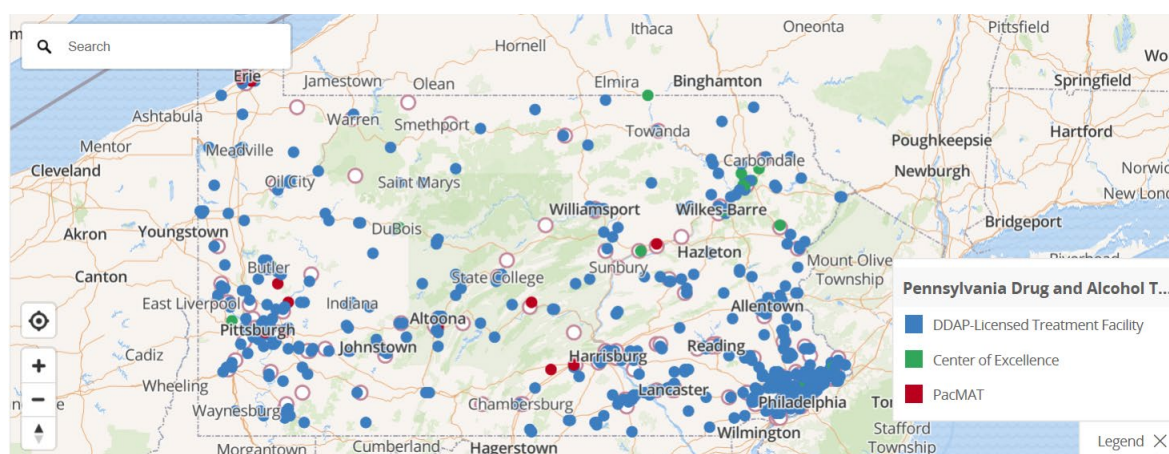
criminal justice system, and other opioid-related diseases (e.g., neonatal abstinence syndrome, hepatitis C, HIV). The new section entitled **Learn More About Opioids** links users to other resources and data, and the section entitled **View Source Data** connects visitors to the Open Data platform, from which they can export datasets for their own analyses and create maps and charts for their specific needs. The Community Impacts section was funded by a \$1 million, two-year grant from the Aetna Foundation, which is enabling the state to expand the Dashboard and add new data sources.

As of mid-June 2019, the first release of the section on the Impact of the Opioid Epidemic on Families and Children was operational. It displays maps showing the annual rate of maternal OUD present at delivery by county, the annual rate of newborns on medical assistance with withdrawal symptoms or affected by maternal addictive drug use by county, as well as other data. Additional releases are forthcoming in the second half of 2019. Descriptions of two maps located on the Dashboard are provided below.

Map of Pennsylvania Drug and Alcohol Treatment Facilities

A [map](#) of the approximately 900 licensed drug and alcohol treatment facilities in Pennsylvania (Figure 3) can be found in the Getting People into Treatment section of the Dashboard. The map (below) shows the location of inpatient and outpatient facilities that provide treatment for OUD and other substance use disorders. Color-coding on the map distinguishes DDAP-Licensed Treatment Facilities (blue dots); the state's Centers of Excellence, which primarily treat people on Medicaid with OUD (green dots); and Pennsylvania's Coordinated Medication-Assisted Treatment (PacMAT) programs (red dots).¹⁸ The name and type of facility, address, and phone number are visible by hovering over the dot on the map. A search function enables individuals to enter the name of a county or a specific (e.g., home) address to find nearby facilities. Data supporting the map are updated quarterly.

Figure 3. Pennsylvania Drug and Alcohol Treatment Facilities

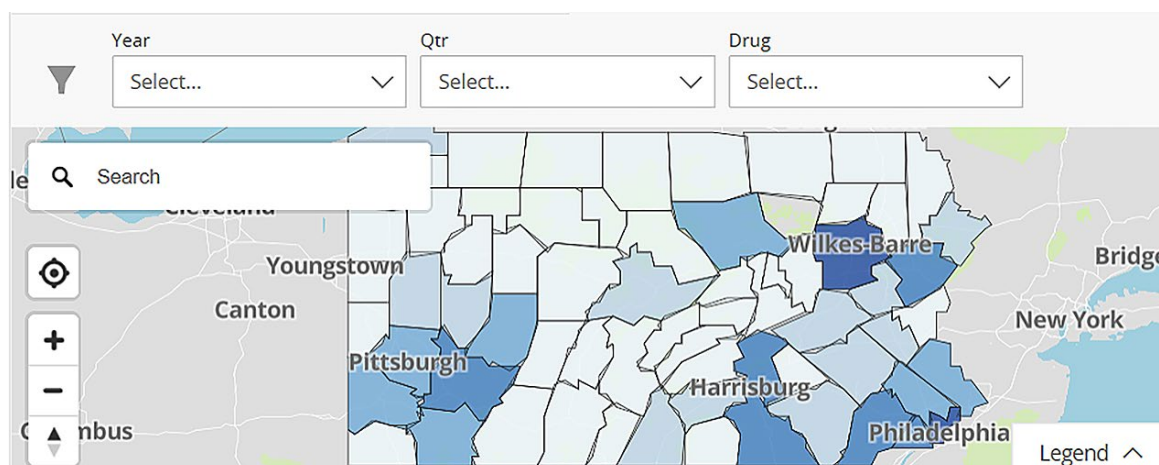


Map of Opioid Seizures and Arrests by Pennsylvania State Police (PSP): 2013-2019

The Preventing Addiction section of the Dashboard displays a [map](#) (Figure 4) of opioid seizures and arrests by the Pennsylvania State Police from January 2013 through March 2019. Seizures occur as a result of undercover buys, search warrants, traffic stops, and other investigative activities. Dashboard users can hover over each county on the map and see the number of opioid seizures (incident count), the number of arrests, and the seizure amount. Users can also filter the data by

selecting the year or years, quarter, and/or drug (heroin, opium, fentanyl) of interest. Filtering the map's data for a single drug, for example, provides more meaningful results about the seizure amount, because potencies for the three drugs varies considerably. The dataset for the map is provided by the Pennsylvania State Police and is updated quarterly. Data for the maps can be updated as needed – from automating updates daily to annually.

Figure 4. Opioid Seizures and Arrests, 2013-2019



Software

Pennsylvania uses the [Socrata Open Data Portal](#), owned by Tyler Technologies, a public company based in Texas, for their Opioid Dashboard and its Open Data platform. DDAP and other state staff have found the platform relatively easy to use, as they can create maps without assistance from information technology (IT) staff or other technical support. Tyler Technologies has been responsive to DDAP's requests for custom modifications and new ideas for presenting the state's data – for example, displaying data from more than one dataset on a map. The Open Data platform is available to all state agencies.

Financing

In March 2018, Pennsylvania received a \$1 million, 2-year grant from the Aetna Foundation to update and expand the Dashboard and create Opioid Dashboard 2.0. These funds also support personnel at the DOH and the University of Pittsburgh School of Public Health (see below).

Key Partners and Staffing to Support Pennsylvania's Dashboard

The Dashboard is the responsibility of several staff. The Special Advisor to the Secretary of Health provides overall leadership for the project. She has support from a DDAP staff member, a DOH Project Manager, an Open Data Officer who uploads datasets to the platform, and researchers from the University of Pittsburgh School of Public Health. Depending on the dataset, staff within DDAP, the Department of Health, or researchers at the university work with agency data owners to create the maps or graphs to determine the best ways to visually represent the data and make the data most useful to potential users – policymakers, community leaders, and the general public. Staff within the Department of Health's communications office review content and language of all Dashboard pages and materials before they are published.

THE IMPACT

Although the state's utilization of mapping and data visualization to aid in addressing the opioid crisis has been in place for just over a year, several benefits are already evident or beginning to emerge.

Improved Communication

Maps and other visual displays of opioid-related data have facilitated communication with state policymakers, community leaders, journalists, and the general public about the opioid crisis. Accompanied by text, the maps and charts tell the story of the epidemic and enable the state to show its progress and ongoing challenges in addressing the crisis. It has been accessed an average of approximately 2,300 times each month since its March 2018 launch. Visits to the Dashboard are expected to increase as more content is added to the Community Impact sections of the website. In addition, the Dashboard and its data are increasingly becoming a part of Command Center conversations. The Command Center is able to discuss data more often and in greater detail – for example, they can consider the differences across the state at the county level.

“For each data set, we ask ourselves about the information or “story” we want to convey through the use of data. We also ask whether mapping or graphing will be more impactful in telling that story.”

—DDAP staff

Informed Decision Making

Data mapping has enabled state and local officials, including those in the Command Center, to see where prevention, rescue, and treatment efforts are most needed. By displaying county-level data on maps, gaps and needs for services are readily apparent – e.g., counties where there are few treatment facilities or areas (e.g., highway corridors) where opioid-related deaths or seizures are highest. Data inform Command Center discussions and state and community planning. The Dashboard also gives the public and local governments current or recent data about the opioid epidemic. Having access to the Dashboard gives them information about what's going on in their area and the data required to take local action.

“One of the key pieces is using data to answer questions that the Department of Health's leadership wants to know – for example, ‘how many children enter the child welfare system annually as a result of a parent/guardian with an OUD?’ We're collecting questions leaders want answered. Eventually, we'll be able to answer virtually any question.”

—DOH staff

Innovation

Making opioid-related data available on the Dashboard through Open Data software encourages new and innovative thinking about the opioid crisis in Pennsylvania. The state hosted [Code4PA](#), a code-a-thon in the Fall of 2018 across four universities, during which researchers, programmers, and others used opioid-related data to identify and create applications that could help address the state's opioid epidemic. Pennsylvania also hopes to use maps on the Dashboard in tandem with other data systems, such as the Overdose Information Network (ODIN), to support innovative prevention, rescue, and treatment approaches by law enforcement and local and state governments. Further, the Socrata Open Data platform enables anyone to download datasets for their own analyses and use the data to create their own visualizations with the support of external tools, such as Tableau, Carto, and Excel. ([Tableau](#) is a type of data visualization software and [Carto](#) is a software package used for mapping.) This capability may spark new strategies and approaches to tackle the state's opioid crisis.

LESSONS LEARNED

The two case studies illustrate the tangible benefits of using GIS for planning and decision making within state substance use agencies. In our interviews with staff who manage GIS or other data visualization operations in Washington and Pennsylvania, we asked about lessons they have learned from their experience.

Software Selection

Careful selection of GIS software is critical for several reasons. First, it is important that the software be comprehensive and flexible. Over time, multiple agencies or departments may want to use the software, and it should be capable of answering questions across programs. Selecting software that is relevant and adaptable across different programs means that costs can be shared, making the initial and long-term investment in GIS more cost-effective. Second, once software has been integrated into an agency's IT infrastructure and staff have been hired and trained to use the software, there are added costs to changing to another software package. Third, learning how to use GIS can be challenging. Selecting software that is widely used in other fields or by other health departments nationally can make it easier to recruit staff with the experience and skills to manage GIS operations. Fourth, the availability of training or training materials should be considered during the selection process. As applications of GIS expand and as new versions of the software are released, training materials will facilitate uninterrupted operations. Finally, states should consider the extent of customization that may be necessary, as well as the funding and staff resources required to add features that meet current and future needs. An off-the-shelf software package will likely require additional customization to meet state needs.

Knowing the Audience

The target audience and its needs should guide product development. Consider the opioid epidemic as an example. Policymakers, program managers, local coalitions, school districts, the media, and the general public can all benefit from spatial data to help them address and understand the crisis. State and local policymakers and program managers, for example, require data to assess the severity of the problem in communities across the state and for policy development and program planning. Community members want information about the extent of the problem in their county, city, or neighborhood and its effects on society. Members of the media seek current and trend data that they can use to report on the crisis. Knowing who the audience is and the diverse needs and backgrounds of various audience segments is critical. With this understanding, substance use agencies can decide on the most appropriate formats and types of data visualization products to develop. Products might include data books, multi-dimensional maps, other visualizations (e.g., pin maps, charts, cartograms that shade or highlight areas based on their output values), data dashboards, briefing slides, Web-based or mobile apps, and other products.

Data Quality and Management

Data quality and management matter. States will likely draw on many state and national data sources for their maps and GIS analyses. States must have systems and protocols to manage the data and ensure it is accurate, complete, easily accessible, and stored securely. The availability of historical and current data is important to produce useful and decision-focused GIS resources. While there is often a time lag in obtaining national survey data, data collected at the state or county level (e.g., data on treatment services, drug-related arrests) can sometimes be updated more frequently. When the public is using GIS applications for queries on the location of treatment providers or when program planners are determining the best areas for services, the availability of current data is especially important.



Agreements for Data Sharing

A memorandum of understanding (MOU) with state agencies for data sharing will facilitate GIS activities. Relevant socio-economic data (e.g., risk indicators) and other data related to substance use are collected in multiple surveys and exist in multiple databases managed by different state agencies. An MOU with these agencies ensures that datasets are available for GIS applications and facilitates communications with these agencies about their data, including data interpretation.

Relationship Building

Building relationships with organizations that have a critical role in substance use prevention, treatment, and recovery will help states achieve the goals set for their GIS projects. For example, strengthening relationships with primary care providers can facilitate referral of patients to substance use treatment through the use of a treatment locator. The success of a state's GIS activities also benefits from relationships with community partners. Sharing maps and GIS analyses with prevention coalitions, county and local health departments, treatment agencies, school districts, and others can empower communities and give them a valuable tool for needs analysis, decision support, and selection of evidence-based programs. Educating community partners on the value of spatial data will promote acceptance and utilization of GIS information. Finally, by building or maintaining relationships with other state agencies that are also using GIS, substance use agencies can learn how GIS is applied in other fields and potentially identify other innovative uses for GIS within their own departments. Substance use agencies may even be able to borrow GIS staff from another agency to jump start new projects.

Ongoing Communication with Users, Data Managers, and Analysts

Ongoing communication with current and potential data users, agency staff who oversee datasets, and statisticians and program managers who analyze data helps to ensure that GIS applications and products stay relevant and fulfill user needs. For example, if there is regular outreach and dialogue about users' information needs, these users are more likely to reach out to the state substance use agency when they have a question that GIS is equipped to answer. Additionally, program managers and statisticians can help prepare compelling stories using GIS and confirm correct interpretation of data before maps and analyses are disseminated.

Staffing

Leadership support and dedicated staff time are required to initiate and sustain GIS activities. Recruiting individuals who have experience with computers, programming, or data is helpful, but not always sufficient. Individuals should also know how to work with spatial data, be familiar with asking geographic questions, and have analytical skills. GIS staff must also be able to collaborate with program staff and senior officials to design GIS applications that answer their questions and help staff interpret maps and geographic data. Additionally, software bugs can happen on occasion. Having experienced staff who are able to find work-arounds when this occurs is helpful. Finally, a successful, in-house GIS initiative needs a champion at a senior level. This is essential for securing sustainable funding and for building collaborations with other state agencies and community partners.

CONCLUSION

It was a revelation in the 1850s when Dr. John Snow was able to demonstrate on a map the relationship between an outbreak of cholera and a single pump that supplied water to the most affected residents of London. Today, GIS makes it possible to analyze relationships that are far more complex. GIS technology can support decision making. It can put resources such as information about MAT providers, where to find naloxone, or the location of prescription drop boxes at an individual's fingertips. With GIS, state substance use agencies can illustrate trends in substance use at the county or neighborhood level. They can use GIS maps to tell the story of the opioid epidemic, not just the tragic number of opioid-related deaths but the broad societal effects of opioid use – an increase in hospitalizations, the rising number of emergency calls to police and EMS, more children entering foster care, and an uptick in the number of babies born with neonatal abstinence syndrome. It can also show the number of lives saved with overdose-reversing naloxone and the reversal of negative trends such as a decline in the misuse of prescription drugs. With GIS, a compelling story can emerge – it may be devastating or inspiring, show worsening or improving conditions, motivate and guide action, help policymakers and program directors make informed decisions, and increase community awareness.

GIS continues to evolve. Advances in technology on many fronts – location sensors and cameras throughout communities, the ability to store and analyze large and complex collections of digital data (“big data”) using the Cloud, the accessibility of large databases through open data platforms, the ubiquity of smartphones and mobile devices, advances in artificial intelligence, and the growing number of innovative mobile applications in public health – will contribute to the increasing utility and appeal of GIS for analysis, communication, and decision support. GIS maps also will likely become increasingly dynamic, enabling users to interact with them, explore decision alternatives, and visualize their potential impact.^{19, 20}

With GIS, state substance use agencies have a powerful tool they can now use, as exemplified by the two cases presented in this Issue Brief. For many states, GIS is transforming the way they manage programs, make decisions, communicate information, and solve their most urgent substance use issues.



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REFERENCES

1. GIS Geography (2019). 1000 GIS Applications – How GIS Is Changing the World. Accessed on July 20, 2019 from <https://gisgeography.com/gis-applications-uses/>.
2. Musa et al. (2013). Use of GIS Mapping as a Public Health Tool--From Cholera to Cancer. *Health Services Insights*. 6:111–116. Accessed on July 18, 2019 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4089751/>.
3. Aghajani, J., Farnia, P., Velayati, A. (2017). Impact of Geographical Information System on Public Health Sciences. *Biomedical Biotechnology Research Journal*. Accessed on July 20, 2019 from: <http://www.bmbtrj.org/text.asp?2017/1/2/94/219104>.
4. Musa et al., 2013.
5. Walsan, R., Pai, N., & Dawes, K. (2016). Usefulness of Geographic Information Systems in Mental Health Research. *Manipal Journal of Medical Sciences*. 1(2): 42-45. Accessed on July 19, 2019 from http://ejournal.manipal.edu/mjms/docs/Vol1_Issue2/full/8_6-Copycleaned-Ramya.pdf.
6. Washington State Health Care Authority. Behavioral Health and Recovery. Website: <https://www.hca.wa.gov/about-hca/behavioral-health-and-recovery-0>, Accessed on May 24, 2019.
7. Washington uses state and national data, including administrative/agency data, Healthy Youth Survey data, natural resource and use data, and data from the Washington State Office of Financial Management Forecasting Division for GIS activities related to substance use prevention and treatment.
8. ZCTA(s): Zip Code Tabulation Areas, for which US Census Bureau reports tabular data; similar, but not identical to USPS ZIP Codes.
9. University of Washington Alcohol & Drug Abuse Institute. Opioid Trends Across Washington. Accessed on May 24, 2019 from https://adai.washington.edu/WAdata/opiate_home.htm.
10. Athena. Community Prevention and Wellness Initiative. Accessed on May 24, 2019 from <https://www.theathenaforum.org/community-prevention-and-wellness-initiative-cpwi>. An Educational Service District in Washington provides services to multiple school districts on a regional basis.
11. CORE-GIS (Community Outcomes and Risk Evaluation Geographic Information System) is a comprehensive collection of data related to substance use, abuse, and risk and protective factors.
12. Pennsylvania Department of Drug and Alcohol Programs. Accessed June 5, 2019 from <https://www.ddap.pa.gov/Pages/About.aspx>.
13. Centers for Disease Control and Prevention. (2018). Vital Signs: Trends in Emergency Department Visits for Suspected Opioid Overdoses – United States, July 2016 – September 2017. *MMWR*. March 9, 2018. Accessed June 5, 2019 from <https://www.cdc.gov/mmwr/volumes/67/wr/mm6709e1.htm#T2> down.
14. Drug Enforcement Administration. The Opioid Threat in Pennsylvania. Joint Intelligence Report. September 2018. Accessed June 5, 2019 from <https://www.dea.gov/sites/default/files/2018-10/PA%20Opioid%20Report%20Final%20FINAL.pdf>.
15. Kaiser Family Foundation. Opioid Overdose Death Rates and All Drug Overdose Death Rates per 100,000 Population (Age-Adjusted). Accessed June 5, 2019 from <https://www.kff.org/other/state-indicator/opioid-overdose-death-rates/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D>.
16. Governor Wolf Declares Heroin and Opioid Epidemic a Statewide Disaster Emergency. January 10, 2018. Accessed June 5, 2019 from <https://www.governor.pa.gov/governorwolf-declares-heroin-and-opioid-epidemic-a-statewide-disaster-emergency/>.
17. Governor Tom Wolfe. 2019. Gov. Wolf Signs Sixth Opioid Disaster Declaration Renewal, Announces New Initiatives. Accessed June 22, 2019 from: <https://www.governor.pa.gov/newsroom/gov-wolf-signs-sixth-opioid-disaster-declaration-renewal-announces-new-initiatives/>.
18. White dots indicate more than one treatment facility at a location; the type of facilities is shown when hovering over the dot.
19. Szukalski, B. & Ball, M. (2018). Mapping the Future of GIS. Accessed on July 23, 2019 from <https://www.esri.com/about/newsroom/blog/mapping-future-gis/>.
20. Goodchild, M. (2005). GIS and Modeling Overview. In D.J. Maguire, M. Batty, and M.F. Goodchild, editors, *GIS, Spatial Analysis, and Modeling*. Redlands, CA: ESRI Press, pp. 1–18. Accessed on June 23, 2019 from <http://geog.ucsb.edu/~good/papers/414.pdf>.