OHIO OPIOID ANALYTICS PROJECT
SCOPE OF WORK

Background

In 2016, unintentional drug overdoses caused the deaths of 4,050 Ohio residents, a 32.8 percent increase from 3,050 overdose deaths in 2015 (ODH). Ohio had the fourth highest overdose death rate in the nation at 29.9 per 100,000 (CDC). The numbers of unintentional overdose deaths have slowly increased year after year in Ohio since the early 2000's. Deaths caused by prescription opioid overdose began to climb in 2010, followed by an increase in unintentional heroin overdose deaths in 2012. The most significant spike in overdose deaths, however, is attributed to the synthetic opioid fentanyl. Fentanyl overdose deaths jumped from 75 deaths in 2012 to 2,357 deaths in 2016 – a 92.7 time increase.

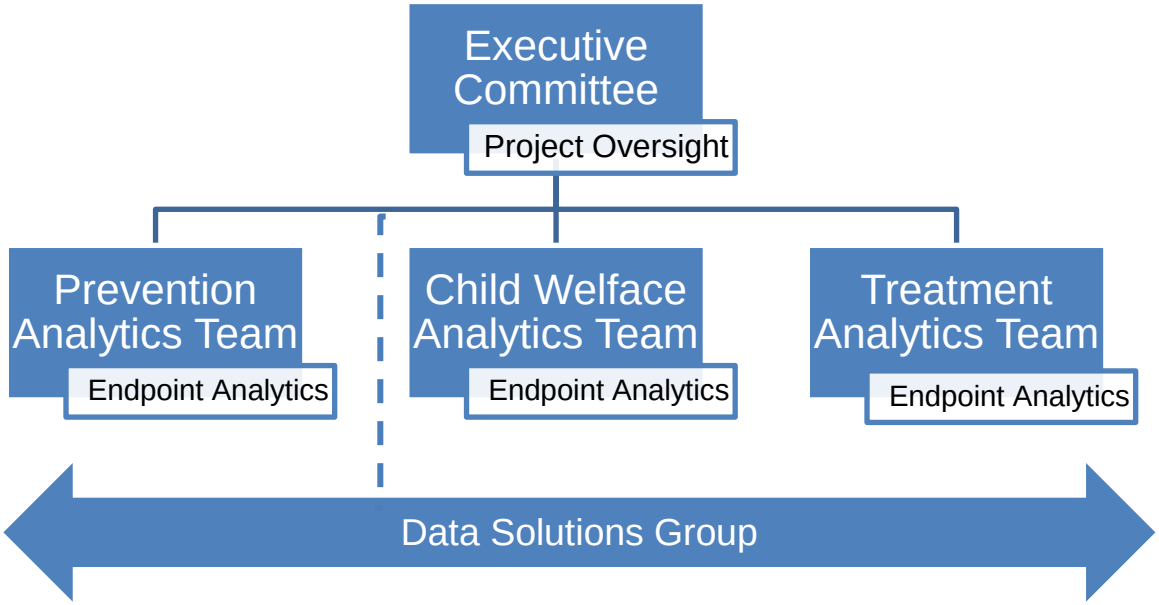
The State of Ohio has taken bold action to fight opiate abuse and to reduce the number of deaths caused by accidental opioid overdose. Initiatives have been launched to: 1) Curb over-prescribing of opioid pain medication; 2) shut down "pill mills"; 3) increase illegal drug seizures; 4) empower healthcare providers and families to prevent and address drug abuse; and 5) make the opiate overdose reversal drug Naloxone widely available to the public. The number of opioid doses dispensed to Ohio patients decreased by almost 162 million between 2012 and 2016 (GCOAT) and the state has invested over $1,000,000 annually to make naloxone, an opioid overdose antidote, available to first responders and communities. Despite the state's aggressive campaign to limit access to opioids, crack down on illegal opioid trafficking, prevent deaths with widespread naloxone access, and treat opioid addiction, the death toll from opioid addiction continues to rise.

In order to guide future state efforts to address the Ohio opioid crisis, ODM and ODHE recognize the need for rigorous research and data solutions to identify the factors that contribute to opioid endpoints. GRC will assist ODM to engage leading content experts who will develop and implement analytic strategies for the purpose of identifying high risk groups and potentially modifiable factors related to critical opioid endpoints. Advanced data analytic strategies such as spatial analysis and artificial neural networking will be used to provide insight into regional and sub-regional factors to increase the accuracy of predictions related to opioid endpoints.

An Executive Committee (EC) of academic and state agency subject matter experts (SMEs), healthcare administrators, and clinicians will provide direction and oversite regarding the research design and methodology of the Ohio Opioid Analytics Project. Opioid Analytics Teams (OATs) will be established around core domains of opioid-related endpoints (e.g., treatment, child welfare). A Data Solutions Group will support the project's data infrastructure and deliverables. Figure 1 shows the organizational structure of the project. A minimum of three core domains of opioid-related endpoints will be identified by the EC in collaboration with ODM:

1. *Prevention* including opioid endpoints such as dependency, addiction, recovery, overdose, and death. These will include endpoints that align with the Ohio Board of Pharmacy (BOP) dashboard;
2. *Child Welfare* including opioid endpoints impacting children and families, such as neonatal abstinence syndrome (NAS) and out of home placement (foster care);
3. *Treatment* including medication assistant treatment (type, dose, duration), psychosocial treatment and factors influencing treatment retention (e.g., housing and other supports) identified in project development or data analyses; and
4. Additional endpoint domains will be included at the request of state sponsors.

Figure 1: Ohio Opioid Analytics Project Organizational Structure



Using methods and data sources identified in Table 1, the OATs will apply similar methods to each opioid-related endpoint including spatial analysis, logistic regression, survival analysis, and artificial neural network methodology (see Table 1 for detail). Collaboration with other state research initiatives may be sought through the State University Partnership Learning Network (SUPLN) located at Academy Health and the Medicaid Medical Directors Network (MMDN) located at Academy Health to draw conclusions about impacts to state policies. Modifiable and non-modifiable risk factors and their indicators (IVs) will be identified by the EC and will include at a minimum:

1. Regional trends in opioid prescribing and drug trafficking, access to local treatment programs and providers, MAT (methadone, naltrexone, buprenorphine), and naloxone;
2. Social determinants such as safe and stable housing, employment, demographics, economic health of geographic area, criminal history); and
3. Involvement in child protective services, access to other supports, and factors identified by EC and requested by state sponsors.

Predictive models and data solutions will be developed for use by state leadership to inform program and policy decisions. Point-of-service models and tools will be developed to support decision-making at points of contact with clinicians and other potential change agents (e.g., pharmacists, law enforcement officials).

Scope of Work

1. An Executive Committee (EC) of state, clinical, and analytic and policy experts will be selected by the state sponsors to assure that the OOAP deliverables meet expectations of their potential customers, including state leadership, clinicians, and other potential customers. Representation will be sought from the Ohio Department of Mental Health and Addiction Services, the Ohio Department of Health, and the Ohio Supreme Court Specialty Drug Court. The EC will review proposed methods and provide guidance regarding research questions and methods, and will be responsible for oversight of the data analytics and research methodologies employed by each of the OATs. The EC will meet at least quarterly throughout the duration of the project.

2. At least three Opioid Analytics Teams (OATs) will be established to plan, develop, and execute the research around distinct clusters of opioid endpoints: *Prevention, Child Welfare, and Treatment.* OAT team members will include research and data analytic experts across the state with experience in opioid endpoint research, spatial analytics, and logistic regression. Each OAT will have a research lead assigned and a project manager to ensure team tasks are executed as approved by the Executive Committee.

3. The objectives include:
    a. Develop and implement predictive models to identify and characterize risk factors for opioid-use endpoints and to estimate how changes in modifiable factors (e.g., programs and policies) may influence endpoint trajectories over time. Conduct analyses to address the following research questions:
        i. What modifiable and non-modifiable factors predict the critical endpoints?
            1. What regions/sub-regions of the state are affected most?
        ii. How could changes in the modifiable factors influence endpoints?
            1. To what extent can regional variation in endpoints be explained by regional variation on local sociodemographic characteristics and programs?
        iii. How have program/policy changes affected endpoint trajectories over time (e.g., Medicaid expansion, pharmacy lock in, guidelines for dosage and duration)?
    b. Develop and implement point-of-service models to identify individual-level factors available at points of contact with clinicians and other potential change agents (e.g., educators, law enforcement) that can be used to prevent and address negative opioid outcomes, including for individuals in recovery. These may include factors available at the point of contact through medical records or other sources (e.g., police report, self-report) that can drive appropriate action (SBIRT, referral, different pain management strategies) in real-time. Conduct analyses to address the following research questions:
        i. What individual-level factors that are available at point-of-contact have an impact on individual risk?
        ii. To what extent can regional sociodemographic differences be used to identify individuals most vulnerable to negative outcomes?
    c. Conduct analyses that focus on potential risk factors available at point-of-service such as behavioral health history, chronic conditions, and demographics that could increase risk of negative opioid-related endpoints.
    d. See Table 1 for additional information about point of service modeling methods, data sources, and measures.

4. Participate in the design and development of visualization displays and data tools to:
    a. Identify modifiable and non-modifiable factors which predict critical endpoints;
    b. Project how changes in modifiable factors may influence endpoints;
    c. Estimate the effects that relevant program and policy changes have on end points over time (i.e., Medicaid expansion, pharmacy lock-in, prescribing guidelines, Ohio SIM models).
    d. Create a point-of-contact tool that can be incorporated into medical records and used by clinicians to recommend action.
    e. Create tools that may be serve other points of contact such as pharmacists, law enforcement, drug courts, naloxone distributers to identify and respond to sociodemographic differences affecting individual risk.

Table 1: Methods and Measures

Predictive Modeling Methods	Point-of-Service Modeling Methods	Data Sources and Measures
1. Logistic regression models to identify relevant IVs and predict impact of change in IVs. Test multiple models using historic outcomes. 2. Spatial modeling. Analysis of georeferenced data to identify spatial and temporal patterns relevant to each opioid endpoint and sociodemographic characteristics that explain regional variations in opioid endpoints. 3. Artificial neural network methodology to identify highly interconnected systems based on past models to make more precise predictions. 4. Survival analysis to estimate time to outcome (death, relapse) given exposures of interest, implementation of legislation 5. Propensity Score Matching (PSM) to evaluate program impact and identify critical risk factors (e.g., which children with propensity for NAS are at greatest risk for negative outcomes?) 6. Quantitative and qualitative analyses of upstream factors of opioid prevalence 7. Collaborate with other research programs through SUPLN and the MMDN to conduct policy impact analysis for Ohio compared to other states.	1. Logistic regression to identify individual level risk factors that clinicians can readily identify and possibly influence to drive treatment in real time (e.g., SBIRT, MAT, comorbid MH). 2. Spatial modeling to identify local resource constraints or protective factors that can increase or reduce vulnerability. 3. Artificial neural networks and machine learning to accommodate changes and weights of covariates in point of service modeling	1. ODM Claims (e.g., substance use disorder and NAS diagnosis, service utilization, MAT, opioid prescribing) 2. SACWIS – ODJFS (CPS involvement due to substance use, out-of-home placement) 3. VDRS – ODH (Cause of death data, drug poisoning/overdose death, Naloxone administration) 4. EpiCenter – ODH (ED admissions for overdose by location and date, presenting problem for ED visits) 5. Vital Stats – ODH (cause of death, demographics) 6. OARRS – Pharmacy Board (Patient history of opioid prescriptions distributed as reported by pharmacy board, small physician offices) 7. Drug Seizures – Public Safety/Ohio HIDTA (drug trafficking, drug seizures, drug type e.g., fentanyl) 8. Ohio Medicaid Assessment Survey regional data (regional social determinants) 9. Survey Data addressing upstream factors to opioid prevalence