Using Innovations in Sensing, Data Analytics, and Community Engagement to Address Opioid Overdose Crisis

Sherif Abdelwahed, Alex Krist, Jacqueline B. Britz, Sarin Adhikari, Virginia Commonwealth University

Nasibeh Zohrabi, Penn State University

PG, FY2021

Problem: Drug overdose is now the leading cause of death for Americans under 50. According to the VA Department of Health, fatal drug overdose has been the leading method of unnatural death in Virginia.

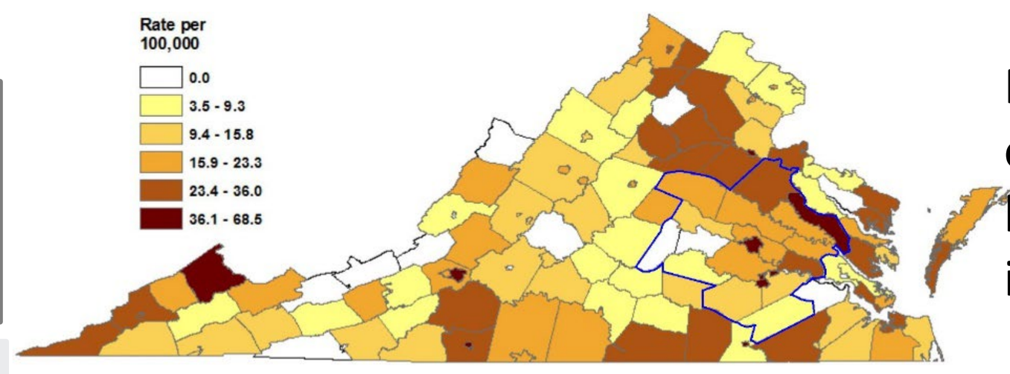
Project Vision: Accurate monitoring opioid overdose in Greater Richmond Area, VA, and build a system model, to capture the complex network of factor, that influence opioid use prevalence and accurately identifies the adverse effects on the community.

This project aims to utilizing customized sensing, data management, and smart technologies solutions to develop a novel approach to address opioid use disorder.

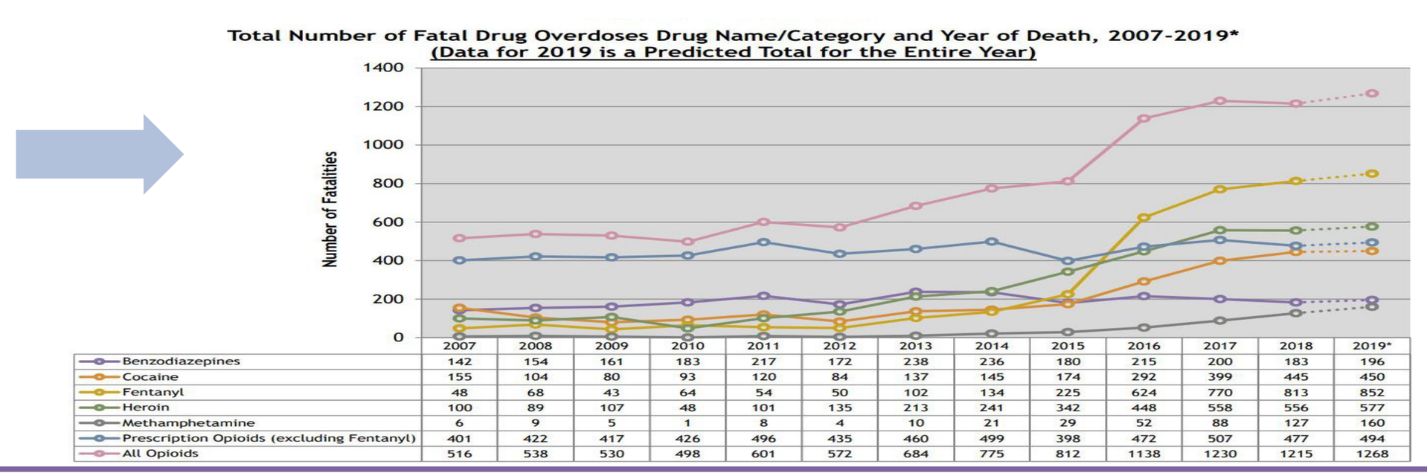
Community: Richmond Metropolitan Region

Medical Examiner of Virginia found that of the 1,230 opioid-related deaths in 2017, nearly 95% of all fatal opioid overdoses were accidents.

In 2018 there was an 11.5% rise in fatal cocaine overdoses and a 44% rise in methamphetamine overdose fatalities compared to data from 2017. Also, fentanyl resulted in the deaths of 813 people in VA, which is an increase of sixteen times the rate seen pre-2013.



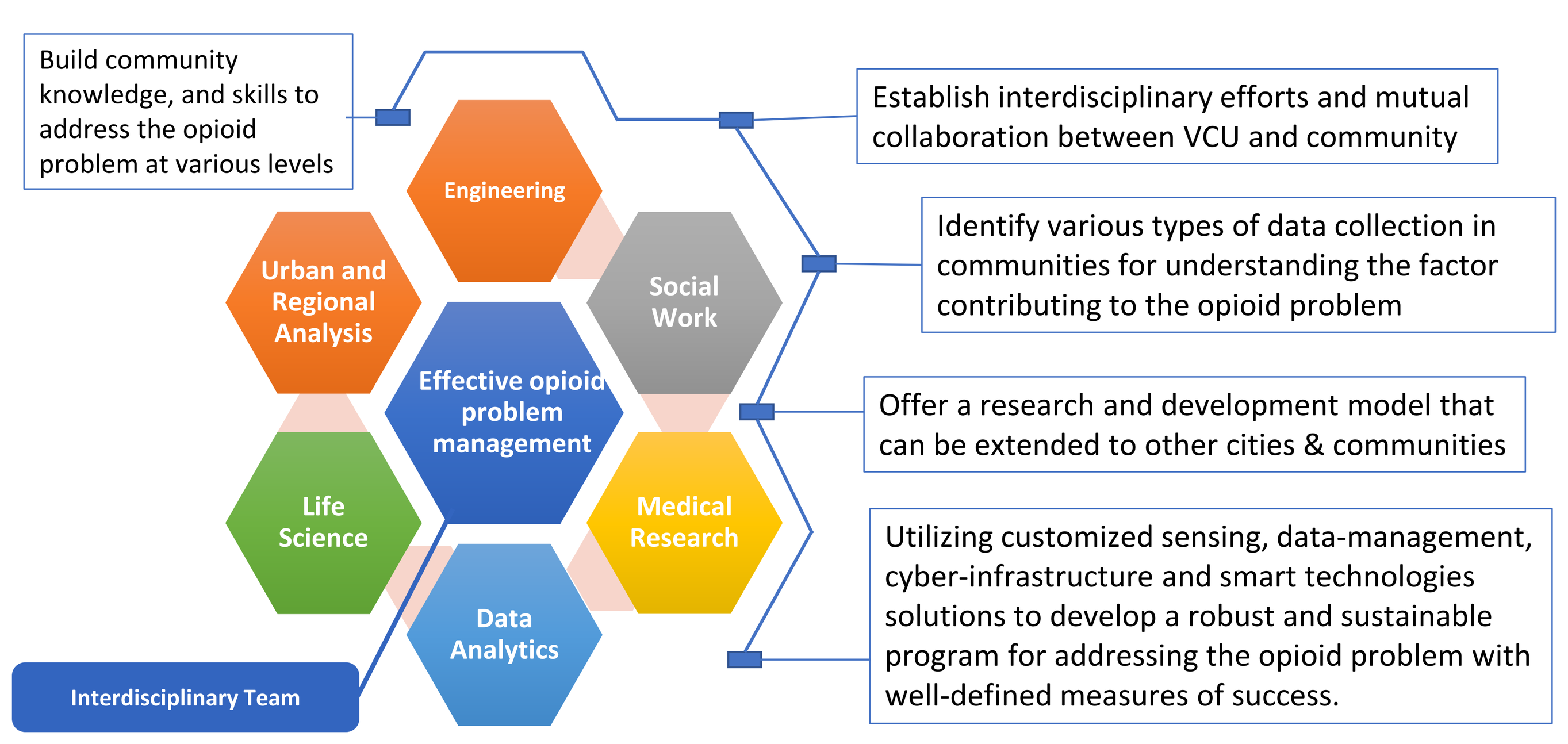
Rate of all fatal drug overdoses by locality of overdose in Virginia, 2018



This planning project aims to investigate novel methodologies for collecting, managing and analyzing more diverse data of illicit drug use and overdoses to assist communities and city planners in addressing the ongoing opioid problem.

Intellectual Merit

- developing a fundamental understanding of challenges facing communities due to illegal drug usage and overdoses,
- developing a better understanding of the relationship between governance, smart cities, and social innovation, particularly for addressing the opioid problem,
- collecting relevant types of drug use data in the community,
- deriving prediction models based on the available data from different sources,
- developing smart sensing solutions to monitor and assess the state of drug abuse.



Project Goal

Investigate several prediction and analysis models for forecasting drug use/overdoses by considering diverse data obtained from different sources.

Emergency Medical Services (EMS) Data

Plan:

- Analyzing emergency medical services (EMS) response data to identify trends and geographic "hotspots"
- To track and map overdoses so medical workers could be pre-staged in high risk neighborhoods.

Approach

- Prompt applications of Narcan for reversing overdoses
- More targeted patrols in neighborhoods with the most serious overdose hotspots
- Pointing experts to places where and when their help is most likely needed - helping them arrive before it's too late

Sewage-based Drug Epidemiology

Small Robots in the Sewage

- Deploying small robots into the municipal wastewater system.
- These robots will collect human waste samples, which will be tested for opiate metabolites.

What Information?

- Significant changes in consumption& which part of the city
- Metabolites are like fingerprints; each drug produces a unique kind after its consumed - main type of drug
- Collective drug habits of communities

Police Data on Drug-related Incidents

- Identifying geographic location of opioid overdoses and drug related arrests
- enabling us to produce hotspot maps

Analyzing socio-demographic characteristics of opioid hotspots

Providing insights into any correlations between opioid usage and various population & neighborhood characteristics

Neighborhood profile

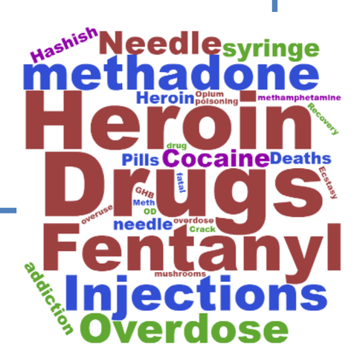
Employment | Family type & size | Age group | crime incidence | Income

Social Networks Data Mining

An additional data source to predict the level of drug usage and identify overdose clusters

- reveal more information on the level of user's interest in drug use
- more information about some people searching for opioid-related keywords who *may overdose in the near future*
- early warnings of overdose clusters
- more information to city officials how to distribute the reverse overdose medication to high-risk areas

Revealing hidden information about the users writing about their experience or interest in drugs



Broader Impact – Society:

- Build the resources to enhance responses to the opioid epidemic that can be discussed and refined with community members to drive efficient change.
- Harnessing the power of data analytics and smart technologies for developing creative short term and long term solutions for addressing the opioid problem.
- The developed data analysis and other software tools will be freely available to researchers, policymakers, and practitioners

Broader Impact – Sustainability:

- Establish a consortium for people who are working to address the opioid problem in Richmond Area.
- Create the knowledge and tools for community-based sustainable program to deal with the impact of this problem.
- Offer a research and development model that can be extended to other cities and communities.
- Provide measures for evaluating various approaches for the opioid problem and predict the impact of different factors on the problem to help policy makers in decision-making.

Next Steps:

- Organize a workshop where academic and field researchers, service providers and local institutions can establish/strengthen a network of stakeholders that collectively analyze the issue and identify solutions.
- The team is aware of the privacy concerns associated with opioid data As part of this work, we will investigate effective techniques to provide various levels of privacy protections..
- Reach out to other counties around Richmond to collect further sewage data and provide a comparison between the different regions in a way that can identify the relevant factors
- Develop the research plan for NSF SCC-IRG Track 1 proposal submission.