Using Big Data to Predict Future Opioid Trajectories in the City of Cincinnati

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1.STATEMENT OF THE PROBLEM

Despite the public sensitivity to increased overdose deaths, little is known about the prevention strategies using big data. Effective prevention strategies inherently require prediction of future opioid problems; however, researchers have limited or no access to the different data sources that collectively help researchers uncover the identifiable patterns of opioid abuse (Burke, 2016). Given this context, the current study seeks an answer to the research question of: To what extent can a variety of data sources, from different agencies, be employed to predict future opioid trajectories.

2. DATA, MEASURES, ANALYTIC PROCESS

Cincinnati Police Department (CPD) Data
- Reported Crimes
- Suspect and Victim Data
- Arrest Data (Including drug arrests)
- Field Interview Reports (FIR) Data

Cincinnati Fire Department Data
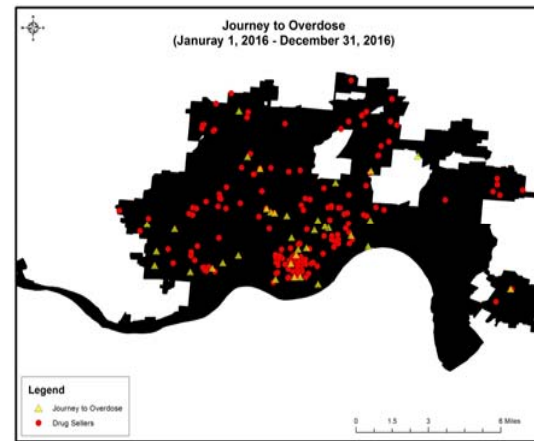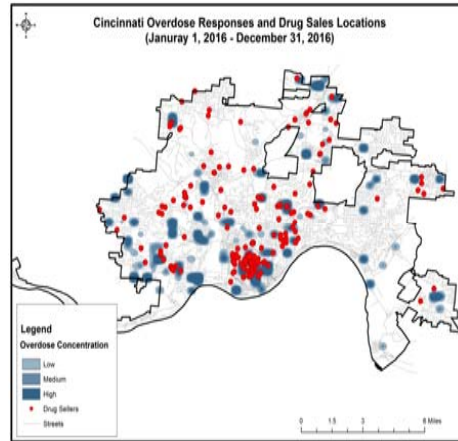- Location of Heroin Overdose Responses

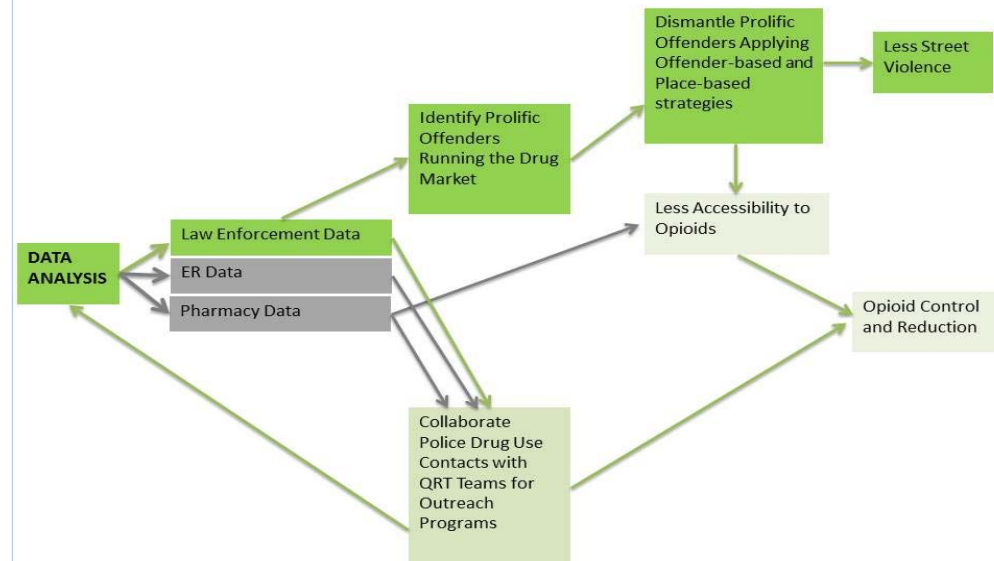**Hamilton County Coroner's Office**
- Overdose Deaths

Methodology of The Study
- Figuring out the police records of overdose victims
- Conducting social network analysis (SNA) to find out to what extent overdose victims are connected to prolific offenders controlling the drug market.
- Identifying spatial patterns of heroin overdoses in the city
- Exploring journey to overdose
- Examining to what extent police contact data can be used in a proactive way to reduce future opioid overdose trajectories.

3. SUMMARY OF RESULTS

Cincinnati Overdose Responses and Drug Sales Locations
(Januray 1, 2016 - December 31, 2016)

Legend
Overdose Concentration
Low
Medium
High
Drug Sellers
Streets

Journey to Overdose
(Januray 1, 2016 - December 31, 2016)

Legend
Journey to Overdose
Drug Sellers

OPIOID CONTROL AND REDUCTION (OCRM) MODEL

Gray colored text boxes suggest that the current study does not have data access for those data sources. For this reason, the likely effects of those missing data sources are also colored with gray arrows due to their unknown status. Darker green text boxes suggest that the current study successfully performs those analyses. If a text box is colored with light green, that means that we need to have more data to perform better detailed analyses.

4. KEY FINDINGS

Individual-based Findings
- Small number of prolific offenders control the drug markets.
- These same individuals are also the primary sources of street violence
- Overdose victims are connected to gang members and prolific offenders that sell drugs. This relationship shows the existence of illicit drug networks that poison drug addicted people and also augments the street violence by monetarily securing prolific offenders' positions in the co-offending network.
- Dismantling this illicit network, using place-based and offender-based policing techniques can reduce overdose deaths by limiting access to opioids and can also reduce street violence by dismantling the illicit drug network
- Eliminating illicit networks; however, may not be adequate to control the spread of opioids in a given jurisdiction. Pharmacy data are needed to identify those persons who abuse the system to gain access to opioids. Analyzing pharmacy data provides a better opportunity to control the diffusion of opioids in the community.
- The current model suggests using police contacts proactively provide outreach to opioid users and providing them with treatment options.
- Using emergency room data (for opioid users) can help police departments to better identify individuals who are in need of outreach program.

Place-based Findings
- There is a high correlation between spatial locations of drug sales and the concentration of overdoses.
- The Southern part of the city has a substantial overlap of overdose victims and drug sales locations. This area alone accounts 30% of overall drug overdoses.
- In 2016, there were 121 overdose deaths within the city limits of Cincinnati. analysis revealed that 62 of 121 overdose victims (51.2%) overdosed at their place of residence. The remaining overdose victims (N=59) traveled an average of 5.5 miles to overdose.
- Further analyses revealed that long distance journeys to known drug sales locations are generally from outsiders/non-residents (N=27). This finding suggests that opposite to Journey to Crime literature, Cincinnati drug sales locations are well known and attract even non-residents from long distances.