INFSCI 2415 Final Report

Shifting Sands: Uncovering the Evolving Landscape of Overdose Fatalities in Allegheny County (2007-2022)

Introduction

In this study, we investigate the patterns and shifts in fatal accidental overdoses in Allegheny County from 2007 to 2022. Through temporal and spatial analyses, we explore changes in overdose incidents, examining trends by location, gender, age, race, and the reasons behind these overdoses. Key findings reveal significant shifts in overdose locations, demographic impacts, and the substances involved, particularly before and after 2017.

Figure 1: Line Plot

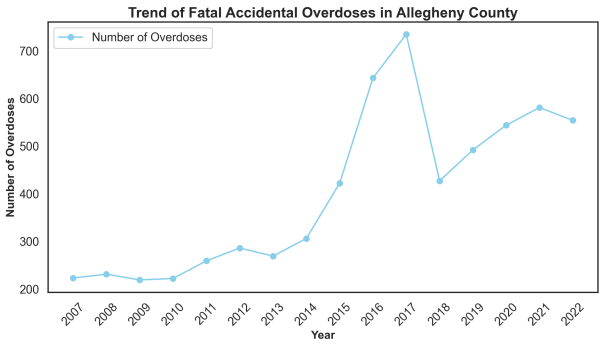

Figure 1: This line graph shows the annual trend of fatal accidental overdoses in Allegheny County over a 15-year period.

Legend:

- Line: Represents the annual count of fatal accidental overdoses.
- X-Axis: Years
- Y-Axis: Number of Overdoses

Figure Description:

- This line graph shows the annual trend of fatal accidental overdoses in Allegheny County over a 15-year period.
- It provides a clear depiction of changes in the number of overdose cases over time, highlighting any significant increases or decreases.

Observations and Findings:

- From 2007 to 2014, there is a gradual increase in overdose cases. A significant increase is observed from 2014, with the number peaking in 2017.
- Post-2017, there is a sharp decline in the number of cases, followed by a period of fluctuation with a general downward trend.
- The year 2017 stands out as a change point, marking the peak of overdose cases, which informed the decision to divide the analysis into two periods: before and after 2017.

Figure 2: Map Plot

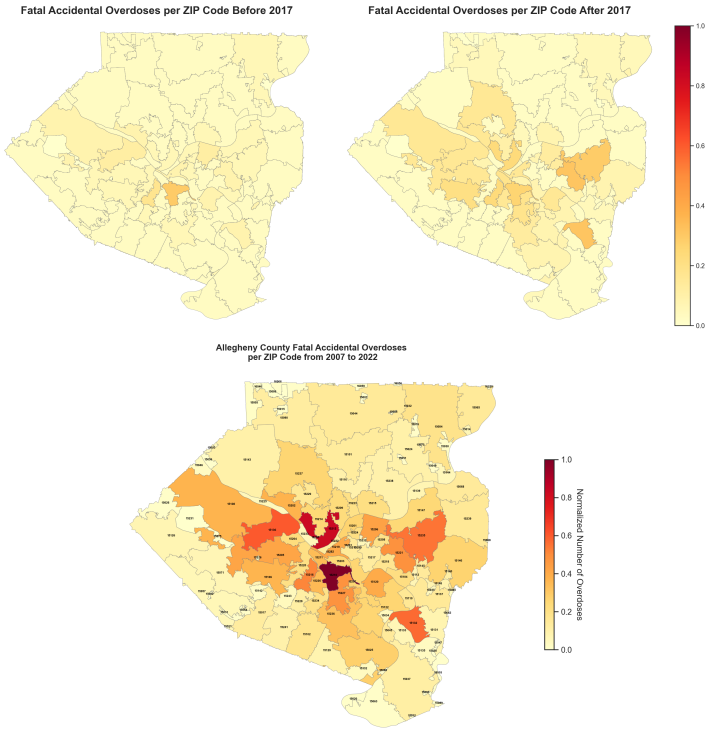

Figure 2: The upper map shows the spatial distribution of overdose cases in Allegheny County before 2017, and after 2017, the lower map shows patial distribution of overdose cases in Allegheny County throughout 2007 to 2022.

Legends:

- Color Gradient (Both Maps): Represents the normalized number of overdoses, with darker shades indicating higher frequencies.
- Geospatial Boundaries: Distinct lines demarcating each ZIP code area in Allegheny County.
- ZIP Code Annotations: Black text labels indicating the ZIP code of each demarcated area.
- Colorbar (to the right): A spectrum from yellow to dark red, representing the range of normalized overdose occurrences in the county.

Figure Description:

- The maps provide a comparative spatial analysis of fatal accidental overdoses in Allegheny County, highlighting changes in the distribution by ZIP code from before to after 2017.
- They enable a visual comparison of overdose hotspots and potentially emerging trends in different areas.

Observations and Findings:

- Before 2017, the majority of overdose cases were concentrated in specific areas, particularly in the ZIP code 15210.
- After 2017, there is a noticeable shift in overdose case distribution, with an increase in cases in different parts of the county, indicating changing patterns in drug use and availability.
- This shift could suggest a change in the drug use pattern, availability, or the effectiveness of public health interventions in different regions.

Figure 3: Word Cloud

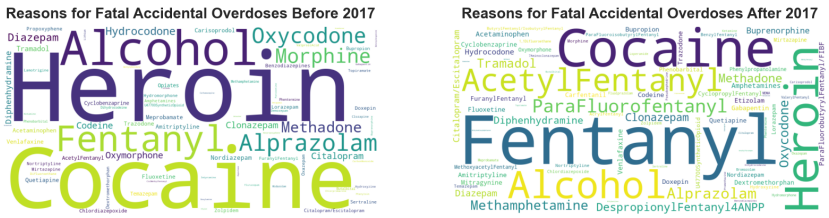

Figure 3: This figure presents a visual comparison of the substances involved in fatal accidental overdoses in Allegheny County, highlighting the prevalence of specific drugs before and after the year 2017.

Legend:

- Right Panel (After 2017): Word size reflects frequency, with "Fentanyl," "Cocaine," and "Heroin" being the most significant post-2017.
- Left Panel (Before 2017): The size of each word indicates its relative frequency as a reason for overdose, with "Cocaine," "Heroin," and "Alcohol" being the most prominent.

Figure Description:

- This figure presents a visual comparison of the substances involved in fatal accidental overdoses in Allegheny County, highlighting the prevalence of specific drugs before and after the year 2017.
- The word clouds are generated from the dataset of overdose reasons, emphasizing the change in drug use patterns over time.

Observations and Findings:

- After 2017, "Fentanyl" has become a predominant term alongside "Cocaine" and "Heroin," showing a significant shift in the overdose landscape.
- The comparison reflects a public health concern with the rise of Fentanyl, a potent synthetic opioid, in more recent years.

Figure 4: Bar Plot

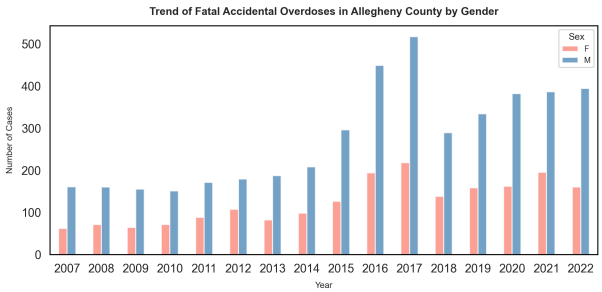

Figure 4: The bar chart provides a year-by-year comparison of fatal accidental overdoses between male and female genders in Allegheny County.

Legend:

- Blue Bars: Represent the number of overdose cases in males each year.
- Salmon Bars: Represent the number of overdose cases in females each year.

Figure Description:

- The bar chart provides a year-by-year comparison of fatal accidental overdoses between male and female genders in Allegheny County.
- It clearly illustrates the difference in the number of cases between genders and shows trends over time.

Observations and Findings:

- Throughout the observed period, the number of overdose cases has been consistently higher in males compared to females.
- Both genders exhibit a similar trend over the years, with a parallel increase and decrease in cases.

Data Source and Methodology

Data Source:

- Allegheny County Fatal Accidental Overdoses
- Allegheny County ZIP Code Boundaries
- Link to GitHub repository

Methodology:

- Word Cloud Visualization: Highlights prevalent substances in overdoses.
- Spatial Analysis: Maps highlighting the dynamic nature of the overdose crisis, indicating shifts in the epicenters of the epidemic within the county.
- Time Series Analysis: Line graphs depicting overdose trends.
- Gender Comparison Analysis: Bar charts comparing male and female overdose rates.

Data Processing: Included data cleaning, normalization, and outlier treatment using Pandas and NumPy.

Tools Used:

- Data Manipulation: Pandas, NumPy.
- Visualizations: Matplotlib, Seaborn, WordCloud.
- Spatial Analysis: Geopandas.

Significance Statement

The presented visualizations collectively offer vital insights into the evolving nature of the overdose crisis in Allegheny County. They highlight critical aspects such as temporal trends, geographical shifts, changing substance use patterns, and gender disparities. These findings are instrumental for public health authorities in evaluating past efforts, guiding future interventions, and tailoring strategies to address the specific needs and trends within the community. Understanding these diverse dimensions is key to effectively combating the overdose epidemic in the region.