Opioid Mortality in Massachusetts: The Interplay of Socioeconomic Disparities, Political Affiliation, and Policy Responses

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Received November 11, 2024
Accepted March 05, 2025
Electronic access April 30, 2025

This research examines the relationships between socioeconomic factors and voting behavior in various Massachusetts towns and the number of opioid deaths between 2016 and 2023. Using extensive data analysis, the study integrates data from state health departments, economic statistics, and election records to uncover potential correlations between opioid-related deaths and key socioeconomic indicators such as income, unemployment rates, and political party affiliations.
The findings indicate that economic hardship, particularly high unemployment and lower per capita income, is significantly associated with increased opioid deaths, while political affiliations show weaker direct correlations. Additionally, government intervention, including harm reduction programs and policy initiatives like the Healey-Driscoll Administration's Opioid Strategy, plays a crucial role in mitigating opioid-related fatalities.
The research paper also studies the effect of social stigma attached to addiction and disparities in access to government programs due to race, age, and socioeconomic status. The research underscores the necessity of addressing socioeconomic disparities and ensuring targeted public health policies that account for both economic conditions and community-specific interventions. By integrating statistical modeling, case studies, and qualitative insights, this paper provides a data-driven approach that policymakers can use to respond to the opioid crisis in Massachusetts. Keywords: MA Opioid Mortality Rate, Socioeconomic factors, Social Stigma, Access Disparities, Healey-Driscoll Administration's Opioid Strategy

Introduction

Background on the Opioid Epidemic in Massachusetts

The opioid epidemic has been a critical public health issue in Massachusetts, mirroring a broader crisis across the United States. This state, known for its significant historical landmarks and vibrant economic sectors, has faced escalating challenges due to increasing opioid misuse and related deaths over the past decade. The impact of opioid abuse in Massachusetts has been profound, influencing a wide range of socioeconomic factors, from healthcare costs to workforce productivity.

In December 2023, the Healey-Driscoll Administration launched a comprehensive opioid strategy[1], aiming to address the crisis through enhanced public health interventions and community-based support systems like Peer Recovery Support Centers and the Bureau of Substance Addiction Services. This strategic initiative prioritizes accessibility to treatment and overdose prevention measures, reflecting a proactive approach to mitigate the crisis at both local and state levels.

Significance of Studying Correlations with Economic and Voting Patterns

Analyzing the correlations between opioid-related deaths and various socioeconomic indicators, including economic conditions and political voting patterns, is essential. This research can provide insights into the underlying factors contributing to the epidemic. By examining economic variables like income levels and unemployment rates, alongside voting preferences, researchers can identify patterns and trends that may influence or reflect community vulnerabilities to opioid misuse. This approach facilitates a holistic understanding of the epidemic, guiding targeted policy interventions and community support programs.

The Healey-Driscoll Administration's efforts serve as a contemporary case study within this broader analysis. By integrating qualitative data from the administration's strategy, including interviews and local policy evaluations, alongside quantitative data analysis, this research adopts a mixed-methods approach. This integration allows for a more comprehensive assessment of the strategy's effectiveness and its alignment with the observed data trends in opioid-related outcomes across Massachusetts. Such a dual approach not only enriches the research but also aligns it with practical, actionable policy insights.

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Hypothesis/ Objectives

This study aims to answer the following research questions:

1. How do economic conditions, such as income levels unemployment rates, and political voting patterns correlate with opioid-related mortality in Massachusetts towns?
2. What role do government programs and spending play in opioid crisis and treatment?
3. What role do demographic factors (race, age, gender) and social dynamics play in shaping disparities in opioid treatment and prevention efforts?

By addressing these questions, this research intends to highlight factors contributing to the opioid crisis and suggests how targeted government programs can help solve the crisis.

Scope and Limitations

This study focuses on opioid mortality trends in Massachusetts towns from 2016 to 2023. The data is taken from the Massachusetts Department of Public Health and supplemented with election results and economic reports available through the Massachusetts government official portal (mass.gov) and the Public Health Data Warehouse.

The research paper does not use advanced geoprocessing tools, such as thematic maps. This study has few limitations. First, certain factors, such as mental health services and individual-level healthcare access, were not included due to data availability limitations, which may impact the comprehensiveness of the findings. Additionally, the analysis was conducted at the town level rather than the individual voter level, which could affect the generalizability of the results, as broader trends may not fully capture variations in individual experiences and access to resources.

The government response data i.e Opioid treatment program Count (OTP) Average Distance Traveled to OTP Provider, Bup Rx Filled, Individuals Who received Bup's Rx, Naloxone kits Received is not readily available for all the towns in Massachusetts. Five major towns are used to analyze the government response.

Methodology Overview

This study employs a mixed-methods approach, combining:

- Quantitative Analysis: Statistical modeling of opioid mortality rates, economic indicators, and political affiliations using regression analysis.
- Qualitative Analysis: Policy reviews and case studies examining government interventions, such as the Healey-Driscoll Administration's strategy.

Literature Review

Overview of Existing Research on Opioid Addiction and Its Impacts

The serious effects of opioid addiction on both individuals and communities have led to a great deal of research on the subject. Opioid misuse has been repeatedly linked to serious public health issues, such as higher death rates, higher healthcare expenses, and more extensive societal repercussions. Volkow et al. (2014) focused on the neurobiological alterations brought on by opioid addiction, which worsen the cycle of dependency and make it more challenging to kick the habit without medical help. In addition, Florence and colleagues (2016) calculated the cost of The serious effects of opioid addiction on both individuals and communities have led to a great deal of research on the subject. Opioid misuse has been repeatedly linked to serious public health issues, such as higher death rates, higher healthcare expenses, and more extensive societal repercussions. Volkow et al. (2014) focused on the neurobiological alterations brought on by opioid addiction, which worsen the cycle of dependency and make it more challenging to kick the habit without medical help. In addition, Florence and colleagues (2016) calculated the cost of opioid overdose, abuse, and dependence in the US, putting it at $78.5 billion a year for medical expenses, lost wages, addiction treatment, and interactions with the criminal justice system.

Studies Relating Socioeconomic Factors to Opioid Deaths

Recent research has focused on the connection between socioeconomic factors and opioid-related fatalities. In their analysis of the relationship between opioid abuse and financial difficulty, Hollingsworth et al. (2017) discovered that counties with greater unemployment rates had a marked increase in hospitalizations connected to opioid usage[2]. According to this research, opioid addiction may be significantly influenced by economic insecurity. "In a similar vein, Cerdá et al. (2020)[3] investigated the effect of income disparity on opioid deaths and found higher rates of opioid-related mortality are linked to lower socioeconomic position and larger economic gap.

Analysis of Previous Findings on Voting Behavior and Public Health Outcomes

In the sociopolitical domain of public health research, voting behavior has drawn attention as an indication of public health outcomes, especially in regard to opioid addiction. Monnat and Rigg (2016) investigated the relationship between voting trends in the 2016 U.S[4]. presidential election and county-level opioid death rates[4]. They found that areas with high opioid death rates were more likely to support candidates who promised reform. This study sheds light on the ways in which political

environments and voter behavior can impact and be influenced by public health emergencies like the opioid crisis, which in turn reflect larger dissatisfaction and perceptions of policy failure.

When taken as a whole, these studies highlight the intricate relationships that exist between voting behavior, socioeconomic status, and opioid addiction, providing a multifaceted understanding of the epidemic. By presenting a thorough examination of the interactions between these variables in Massachusetts, the current study seeks to expand on these findings and provide knowledge that may help guide future community initiatives and policy responses.

Methodology

Research Design

This study uses a mixed methods approach integrating both quantitative and qualitative analysis. The quantitative component assesses the influence of socioeconomic factors and political affiliations on opioid-related deaths, while the qualitative component analyzes the effects of local government policies, community support, and access to healthcare.

By combining statistical analysis with case studies, the study evaluates how different Massachusetts towns experience and respond to the opioid crisis. The Healey-Driscoll Administration's opioid strategy (Massachusetts Bureau of Substance Addiction Services (BSAS) Dashboard. Retrieved from: (Accessed 2023)) serves as a framework for analyzing government intervention.

Data Sample

The study includes all 351 towns/municipalities in Massachusetts, covering opioid mortality trends from 2016 to 2023.

Municipality	County	Population	DOR Income Per Capita	Opiod Deaths	Democrat Political Majority	Income level
Abington	PLYMOUTH	16,124	30,766	2	47.50% Democrat Majority	Low
Acton	MIDDLESEX	22,891	59,235	3	73.50% Democrat Majority	Medium
Acushnet	BRISTOL	10,350	27,084	2	43.50% Republic Majority	Low
Adams	BERKSHIRE	8,332	19,652	1	60.80% Democrat Majority	Low
Agawam	HAMPDEN	28,705	25,719	0	42.80% Republic Majority	Low
Alford	BERKSHIRE	491	39,980	0	76.90% Democrat Majority	Low
Amesbury	ESSEX	16,650	31,266	1	57.00% Democrat Majority	Low
Amherst	HAMPSHIRE	38,919	16,881	3	84.10% Democrat Majority	Low
Andover	ESSEX	34,477	73,316	3	59.30% Democrat Majority	Medium
Arlington	MIDDLESEX	44,028	47,558	2	83.10% Democrat Majority	Low
Ashburnham	WORCESTER	6,155	29,162	1	77.70% Democrat Majority	Low

A case study approach was used for five towns:

- Boston (urban, high opioid mortality rate, extensive government intervention)
- Brockton (smaller city, significant opioid-related deaths, medium intervention level)
- Barnstable (suburban, moderate opioid mortality, moderate intervention)
- Worcester (urban, high opioid mortality rate, extensive government intervention)
- Andover (affluent, low opioid mortality, limited intervention)

These towns are selected to reflect diverse economic backgrounds, political affiliations, and levels of government intervention.

Data Collection

Data was collected from multiple sources, including:

- Massachusetts Department of Public Health (MDPH): Opioid-related deaths, emergency medical response data, and treatment admissions[5].
- Mass.gov (Healey-Driscoll Administration's Opioid Strategy Dashboard): Government policies, opioid treatment program locations, and harm reduction services[6].
- Economic Data: Collected from Massachusetts state government databases, including per capita income and unemployment rates[5].
- Voting Data: Retrieved from 2016 and 2023 presidential elections to determine town-level political affiliations.

Data Cleaning & Preparation

- **Data Integration:** Merged datasets using county and town identifiers - "DOR CODE".
- **Handling Missing Values:** Used regression imputation to estimate missing unemployment data for 2022 based on 2021 and 2023 trends. The imputed analysis highlights that 2022 data points do not significantly deviate from the overall trends, suggesting that the imputation method used had a minimal impact on the results. A plot showing imputed analysis is in the appendix section.
- **Normalization:** Standardized data formats across different sources.
- **Error Checking:** Cross-referenced trends over time to identify inconsistencies or outliers.

Variables and Measurements

The study investigates the effect of all independent variables on the dependent variable – Opioid Mortality Rate:

Dependent Variable:

- Opioid Mortality Rate: Number of opioid-related deaths per town from 2016 to 2023.

Independent Variables:

- Economic Indicators:
  ○ Per Capita Income (Low: $<$ \$50K, Medium: \$50K-\$100K, High: $>$ \$100K)
  ○ Unemployment Rate
- Political Affiliation:
  ○ Percentage of Democratic voters per town
  ○ Percentage of Republican voters per town
- Government Response Factors:
  ○ Number of Opioid Treatment Programs (OTP) per town
  ○ Naloxone & Fentanyl test strip distribution
  ○ The Presence of Bureau of Substance Addiction Services (BSAS) centers

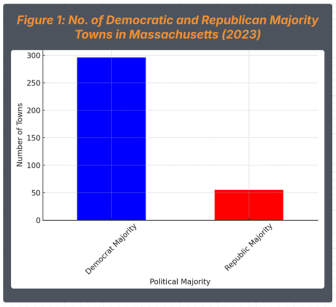
Qualitative Measures:

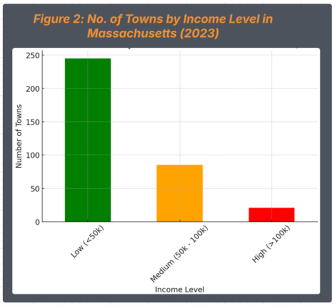
- Social and Cultural Factors: Racial disparities in access to opioid treatment, based on interviews and studies from BOLTS and RIZE.
- Effectiveness of Government Interventions: Case study analysis of opioid-related government policies and their local impact.

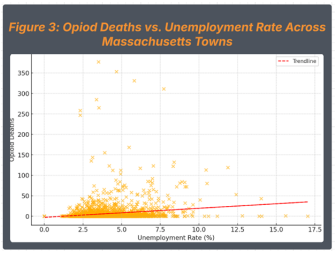
Procedure

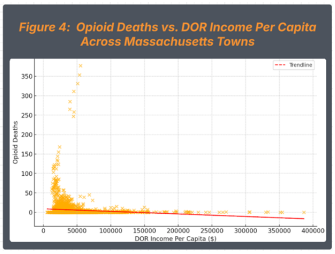
The research followed these steps:

1. **Data Collection:** Retrieved opioid death records, economic statistics, and election results for all Massachusetts towns from 2016 to 2023.
2. **Data Cleaning & Preparation:** Standardized formats, filled missing unemployment data, and merged datasets.
3. **Exploratory Data Analysis (EDA):**
   ○ Descriptive Statistics: Distribution of opioid deaths, income levels, and unemployment rates.
   ○ Visualizations: Scatter plots, box plots, heat maps, and histograms.
4. **Statistical Correlation Analysis:**
   ○ Pearson's Correlation Coefficient: Examined relationships between opioid deaths and economic/political variables.
   ○ Regression Analysis: Identified significant predictors of opioid deaths.
5. **Time Series Analysis:**
   ○ Trend analysis of opioid mortality over time
   ○ Economic indicators vs. opioid deaths over multiple years
6. **Multivariate Regression Analysis:**
   ○ Explored combined effects of economic and political factors.









7. **Path Analysis:**
   ○ Identified indirect relationships between economic hardship, unemployment, and opioid deaths.
8. **Case Study Analysis:**
   ○ Examined government response programs in Boston, Brockton, Barnstable, and Andover, Worcester.
9. **Qualitative Analysis:**
   ○ Reviewed interviews and studies on racial disparities in opioid treatment access from studies and research conducted by independent non-profit organizations in Massachusetts i.e. RIZE and BOLTS.

Data Analysis

To assess relationships between opioid mortality, economic factors, and political affiliations, the study employed the following techniques:

Exploratory Data Analysis (EDA)

The Exploratory Data Analysis (EDA) of the opioid-related data for towns in Massachusetts provides a comprehensive view of the opioid epidemic and its correlation with socioeconomic factors and voting patterns. Majority of towns are the democratic majority and it's proportional to a number of deaths due to opioid deaths. Income level is divided into 3 – low, medium, and high, with less than 50,000 being low and between 50,000-100,000 being medium and above 100K as high income.

- Visualizations:
  ○ Scatter plots (e.g., opioid deaths vs. unemployment rate)
  ○ Time series graphs (opioid deaths over time vs. economic conditions)

Statistical Correlation Analysis

- Pearson Correlation Coefficient:
  ○ Opioid deaths vs. unemployment rate: 0.164 (weak positive, $p < 1.76e\text{-}18$)
  ○ Opioid deaths vs. per capita income: -0.099 (weak negative, $p < 1.63e\text{-}07$)
  ○ Opioid deaths vs. political affiliation: No strong correlation.

Multivariate Regression Analysis

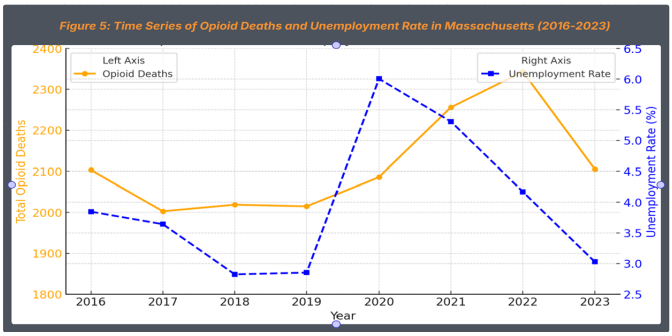
- Key Findings:
  ○ Higher unemployment rates → More opioid deaths ($p < 0.001$)
  ○ Higher per capita income → Fewer opioid deaths ($p < 0.001$)
  ○ Republican voter percentage → Slight negative correlation with opioid deaths ($p = 0.019$)
  ○ Democratic voter percentage → Not statistically significant ($p = 0.350$)

- Model Fit: $R^2 = 0.055$ (5.5% of variance explained).
  ○ Suggests that unobserved factors (e.g., healthcare access, and mental health support) play a significant role.

Path Analysis Interpretation

- Step 1: Economic Factors → Unemployment
  ○ Higher-income → Lower unemployment ($p < 0.001$)

- Step 2: Economic, Political, and Unemployment → Opioid Deaths
  ○ Unemployment is highly significant ($p < 0.001$)
  ○ Political affiliation remains weakly significant ($p = 0.019$)



Time Series Analysis The time series plot illustrates the relationship between opioid deaths and unemployment rates in Massachusetts from 2016 to 2023. The opioid mortality rate fluctuates over time, with a noticeable increase between 2020 and 2022, coinciding with the spike in unemployment due to the COVID-19 pandemic. As unemployment rates decline after 2021, opioid-related deaths also show a downward trend, suggesting a potential link between economic recovery and reduced opioid fatalities. This correlation highlights the impact of economic conditions on public health crises, reinforcing the need for targeted intervention policies.

Discussion

As can be seen from scatter plot analysis, there is a positive correlation between unemployment rates and opioid deaths. A Pearson Correlation Coefficient of 0.164 (weak positive correlation) with a p-value of $\sim 1.76e-18$ (statistically significant) shows a weak but statistically significant positive correlation, suggesting that as unemployment increases, opioid deaths tend to increase slightly. Higher unemployment rates tend to be associated with more opioid-related fatalities, suggesting that economic hardship may be a contributing factor.

The scatter plot between opioid deaths and per capita income suggests a negative correlation. With a Pearson Correlation Coefficient of -0.099 (very weak negative correlation) and a p-value of $\sim 1.63e-07$ (statistically significant), it shows a weak but statistically significant negative correlation, indicating that higher income per capita is associated with a slight decrease in opioid deaths.

There is no strong correlation between the percentage of Democrat or Republican voters and opioid deaths. While some Republican-leaning areas show slightly lower opioid deaths, the relationship is weak. This suggests that political party affiliation itself is not a direct driver of opioid mortality but may correlate with policies, socioeconomic factors, or healthcare access.

As shown above, the multivariate regression analysis shows that economic and political factors significantly influence opioid mortality rates in Massachusetts. Higher-income per capita and wealthier municipalities (EQV per capita) are strongly associated with fewer opioid deaths, while higher unemployment rates correlate with increased fatalities. The model explains only 5.5% of the variance ($R^2 = 0.055$), suggesting that other unaccounted factors such as healthcare access, local policies, and social determinants play a critical role in opioid-related deaths.

Previous studies have extensively explored the impact of socioeconomic factors, policy responses, and political affiliations on opioid-related mortality. Researchers such as Florence et al.[7] have analyzed the economic and neurobiological dimensions of opioid addiction, while Cerdá et al. (2023)[3] highlighted the role of income inequality in opioid-related deaths. By building on these findings, this study further examines how economic disparities, unemployment, and government intervention specifically shape opioid mortality trends in Massachusetts.

Town	Total Population	Per Capita Income	Opioid Related Death	Opioid Related ER Visits	Individuals admitted to BSAS services	Average Distance Traveled to BSAS Provider	Opioid treatment program Count (OTP)	Average Distance Traveled to OTP Provider	Bup Rx Filled	Individuals Who received Bup's Rx	Naloxone kits Received	Naloxone kits Per Opioid Overdose Deaths	Fentanyl Test Strips Received
Barnstable	48916	34697	26	119	428	32	270	10	7871	609	5083	178	2400
Boston	675647	39139	291	1511	6782	11	1978	4	48139	4954	35259	120	45600
Brockton	105643	18116	55	310	988	22	458	3	13042	1203	9117	190	4900
Worcester	206518	22459	133	774	2254	17	1430	4	28285	2600	12412	99	17900
Andover	36569	73,316	4	14	66	16	36	7	799	70	100	1	100

Table 2: Case Study Data

Case Study – Effect of Government Initiatives to combat opioid mortality rate

The sample of five towns/ municipalities is taken and analyzed how opioid deaths in these towns were controlled by government policies and access to opioid-related services offered by the Massachusetts government.

This case study examines the impact of government intervention programs on opioid-related deaths in Barnstable, Boston, Brockton, and Andover, focusing on factors such as emergency response, treatment accessibility, and harm reduction strategies.

Boston, as the largest city, reports the highest number of opioid-related deaths (291) and opioid-related overdose deaths (280), aligning with its substantial opioid-related EMS incidents (2622) and ER visits (1511). However, the city's extensive harm reduction efforts, including 35,259 Naloxone kits distributed and 45,600 fentanyl test strips received, suggest significant government intervention in overdose prevention.

The analysis of the case study suggests that higher government intervention through harm reduction, treatment accessibility, and emergency response correlates with better opioid crisis management, particularly in high-risk cities like Boston and Brockton. Economic stability and lower drug prevalence in towns like Andover also contribute to lower opioid mortality rates. However, a comprehensive approach combining treatment, harm reduction, and socioeconomic support remains crucial in reducing opioid-related deaths across Massachusetts.

Qualitative Analysis – Social and Cultural Dynamics

One of the most important aspects is social and cultural dynamics related to opioid use and deaths. There are growing racial disparities in opioid overdose mortality nationally and in Massachusetts, and there are disparities in receipt of treatment following opioid overdoses in Boston, with Black and Latinx survivors less likely to get treatment than white survivors. The Boston Overdose Linkage to Treatment Study (BOLTS), examined racial/ethnic inequities in access to treatment for people who recently experienced an opioid overdose in Boston[8]. A study funded by RIZE (an independent nonprofit foundation), found that in 2021, the rate of confirmed opioid-related overdose deaths in Boston was approximately 50% higher for non-Latinx Black and Latinx residents compared with white residents[9]. The interview conducted by BOLTS for research paints a very tragic picture of racial inequities in dealing with the opioid crisis:

- Black female describing substance use stigma in her overdose experience– *"Yeah. It is a lot of lack of respect. Especially if they know you're an addict they definitely don't give you the full respect you deserve, because they feel you're an addict, and they feel-remember you're still human, because whether they want to believe it or not, they're an addict too."*
- Black male describing the racism that he experienced at the hospital during his overdose experience– *"That's-to me, I feel like they give more treatment to the White people than they do Hispanics and Blacks"*

A paper published in 2021 by Delman and Adams cited a paper by Taylor-Ritzler et al., 2010, who wrote that Black people could face a "triple stigma" of mental illness, racism, and criminal history. Homelessness adds another dimension to the opioid crisis[8]. In Massachusetts, the drug overdose mortality rate among homeless people ages 25-44 was 16 to 24 times higher than that of the general population.

Ethical Considerations

The study follows ethical research principles. No personally identifiable data was used. All data was collected from publicly available sources. Missing data imputation was clearly documented and had minimal or no effect on results.

Conclusion

This study highlights the multifaceted nature of the opioid crisis in Massachusetts, emphasizing the intersection of economic hardship, government intervention, and racial disparities in opioid-related mortality rates. The findings indicate:

- Economic distress, particularly high unemployment and low-income levels is strongly associated with increased opioid deaths.
- Government intervention, such as the Healey-Driscoll Administration's Opioid Strategy, has contributed to reducing mortality in high-risk areas like Boston, Barnstable, Worcester and Brockton.
- Social and cultural dynamics, including racial disparities in access to treatment, remain a significant challenge, with Black and Latinx residents facing barriers to opioid care.

These results suggest that opioid mortality cannot be addressed solely through medical interventions but requires a holistic approach incorporating economic relief, harm reduction strategies, and racial equity measures. This research extends prior studies

by integrating socioeconomic and political dimensions into opioid mortality analysis, offering policy insights that go beyond traditional healthcare solutions.

Recommendations for Policymakers

1. Expand Access to Treatment and Harm Reduction Services
   - ○ Increase opioid treatment programs and BSAS centers in high-risk towns to ensure accessibility.
   - ○ Strengthen naloxone and fentanyl test strip distribution to prevent fatal overdoses.

2. Address Economic Disparities and Unemployment
   - ○ Implement job training and employment programs for recovering opioid users.
   - ○ Provide financial support and recovery assistance for at-risk populations.

3. Tackle Racial and Social Inequities in Treatment Access
   - ○ Ensure equal access to opioid treatment programs across all racial groups.
   - ○ Address insurance and geographic disparities in healthcare availability.

4. Sustain and expand the Healey-Driscoll Administration's Opioid Strategy.
   - ○ Continue investing in harm reduction and treatment programs across Massachusetts.

By implementing these strategies, Massachusetts can take meaningful steps toward reducing opioid-related deaths and addressing the systemic inequities that fuel the crisis.

Limitations of the Study

This study has few limitations. First, certain factors, such as mental health services and individual-level healthcare access, were not included due to data availability limitations, which may impact the comprehensiveness of the findings. Additionally, the analysis was conducted at the town level rather than the individual voter level, which could affect the generalizability of the results, as broader trends may not fully capture variations in individual experiences and access to resources.

The opioid crisis in Massachusetts is not just a public health issue - it is a socioeconomic and racial justice issue. Although state government intervention has made progress, long-term solutions must integrate economic reforms, equitable healthcare access, and community-based support systems. By taking a data-driven and social equity-focused approach, policymakers can transform Massachusetts into a national model for opioid crisis response.

Acknowledgments

I want to extend my gratitude to Ms. Maggie Labella, Professor at Northshore Community College, Danvers. I started to write this research paper while I was doing a course about "Community Issues and Civic Engagement". Ms. Labella encouraged me to do this research paper. I also want to thank Mr. Karin for his review. He is my AP Stats teacher at The Governor's Academy.

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Appendix

- Imputation Analysis: Used regression imputation to estimate missing unemployment data for 2022 based on 2021 and 2023 trends. The imputed analysis highlights that 2022 data points do not significantly deviate from the overall trends, suggesting that the imputation method used had a minimal impact on the results

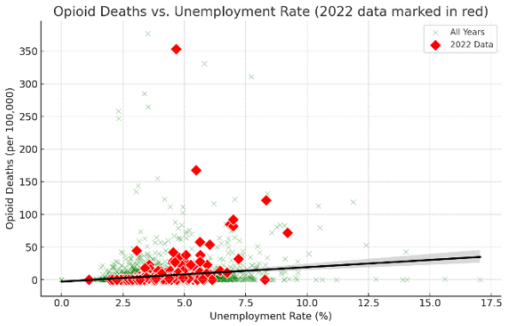

Figure 4A: Scatter plot showing the relationship between Unemployment Rate (%) and Opioid Deaths (per 100,000). Red markers indicate 2022 data points to highlight potential differences.

- Data set and Python code GIT: adityalynnfield/MA-Opioid-Epidemic-Dataset (github.com)