

Gun Violence Team - 1

Deliverable II

Team Members: Shaunak Joshi (Team Lead) (U13870687), Hemant Singh, Marcel Aubry (U02577695), Angela Castronuovo (U68837053)

Contacts:

Bruce Boisman - Client

Policy Director

bruce.broisman@boston.gov

Yagev Levi - Technical Engineer @ BU Spark

yagev@bu.edu

Jacqueline Lin - Project Manager @ BU Spark

linjiaqi@bu.edu

Dataset reference -

[Boston Data](#)

Question-1:

What are the drivers of violence in District 4? How does this compare to the rest of the city?

Datasets used -

- Discipline records from schools for school discipline
 - Dropout Rate - <https://profiles.doe.mass.edu/statereport/dropout.aspx>
 - Weapon on School Premise -
<https://profiles.doe.mass.edu/statereport/dropout.aspx>
- Crime Incident Reports - Analyze Boston -
<https://data.boston.gov/dataset/crime-incident-reports-august-2015-to-date-source-new-system>

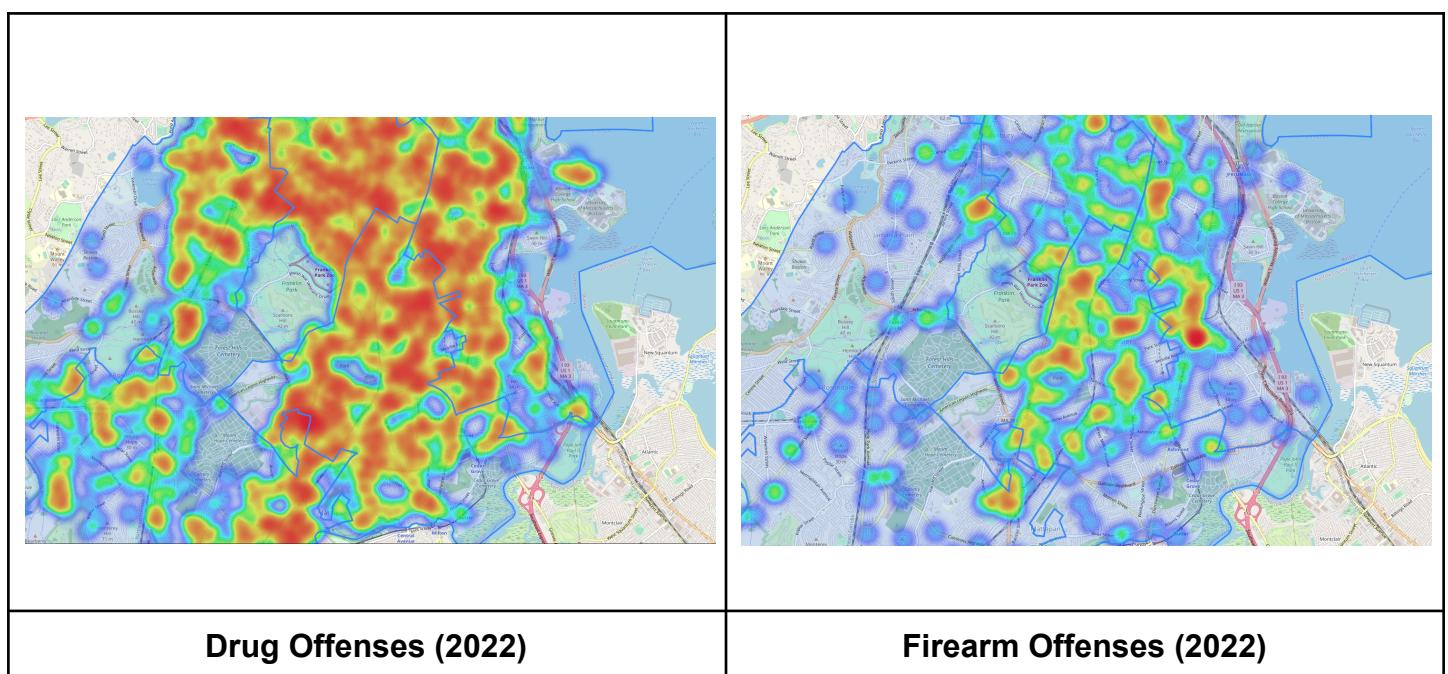
How we answered the question:

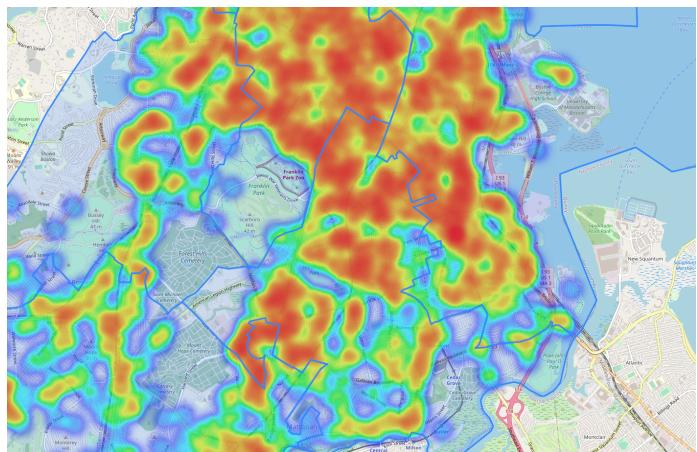
To answer this question, we had looked at the data we had available in our main datasets as well as potential extension datasets to try and see if there was any correlation between certain factors and the violence in District 4. Dropout rates can be regarded as a driver of violence for a multitude of reasons including the fact that these young teenagers now have a lot more time on their hands, may be involved in gang related activities, or are inclined to commit crime as a means for financial gain. Additionally, weapons on high school premises were observed as there is a clear correlation between weapon presence and violence. Next, we are inclined to think that crime is a driver of other crime and therefore we looked into theft, drug, and firearm related offenses in Boston to see how they correlate to overall violence.

How we analyzed the data:

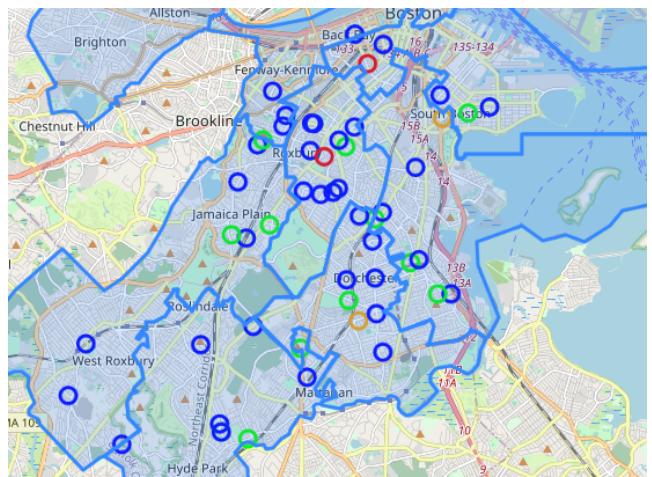
For the dropout rate and weapon on school premise datasets, we mapped out the city of Boston and obtained the address of every high school in the city through the GeoPy library. Then, depending on the amount of dropouts/weapons on school premise offenses, we linearly scaled the data using matplotlib. Finally, we plotted it out onto the mapped city with each district delimiter. For the crime offenses dataset, we used a heat map and GeoPy, as each offense is nicely recorded along with its latitude and longitude.

What does the resulting output look like:

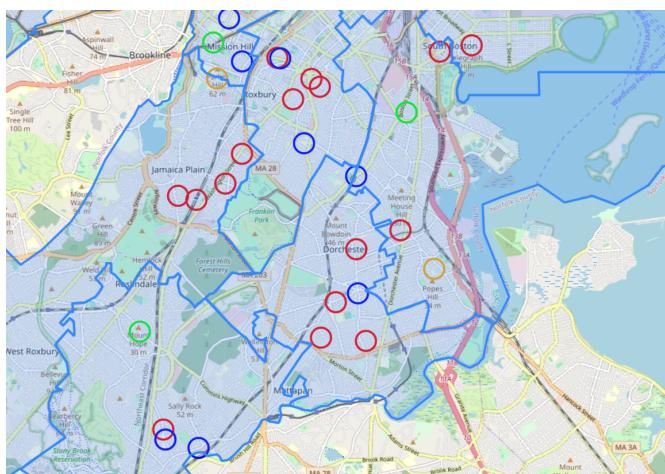




Theft Offenses (2022)



Weapons on School Premise (2022)



Dropout Rate High School (2022)

How does this help us answer the question :

At first glance, we can conclude that indeed crime leads to more crime. This can clearly be seen with drug and theft offenses being strongly correlated to the location of firearm offenses (including carrying, and violent use). There is heavy presence of these offenses in District 4 along with north of it leading into Roxbury and the South End. Nonetheless, District 4 is heavily hit by these offenses. Another point to be made is that these are only the recorded offenses. There is a high likelihood that due to having fewer police stations in District 4, many offenses are not accounted for, and therefore the data does not show the whole story of many offenses committed in District 4. Further, the presence of weapons on school premises has been reported often in and around District 4, with Dorchester having a very high if not the highest number of occurrences. Similarly, the dropout rate of high school students follows the same pattern. We can conclude that these offenses and reports are a part of the leading drivers of violence in District 4. However, there are still more questions to be answered on what the deeper and root cause of violence is.

Question 3:

Are there patterns of violence in terms of location in District 4? How does this compare to the rest of the city?

Datasets used -

Police Department Datasets

- FIO data - <https://data.boston.gov/dataset/boston-police-department-fio>
- Shootings - <https://data.boston.gov/dataset/shootings>
- Shots fired - <https://data.boston.gov/dataset/shots-fired>
- Crime incident reports -
<https://data.boston.gov/dataset/crime-incident-reports-august-2015-to-date-source-new-system>
- Public Transportation (MBTA)
- Supplemental Data used
 - Police districts
 - Police stations in districts
 - Community centers and parks

Early Analysis:

- Less police stations spread near D4 and compared to main Boston. (more easy of violent people to do crime)
- Only one hospital in D4 and compared to main Boston. (bad health and human services strategy to put one hospital)
- Only one university in D4 , but very densely situated universities in the main city. (High school students don't see universities as an aspiration and resort to other methods to earn money. Some of them might choose a criminal path.)
- Parks and greenery is very less in D4 as compared to the rest of the city. (Less greenery might lead to bad mental health situations)

How we answered the question:

To answer the question regarding violence in District 4, we analyzed several datasets, including those from the Police Department and public transportation (MBTA). Additionally, we considered supplemental data such as police districts, police stations in districts, community centers, and parks.

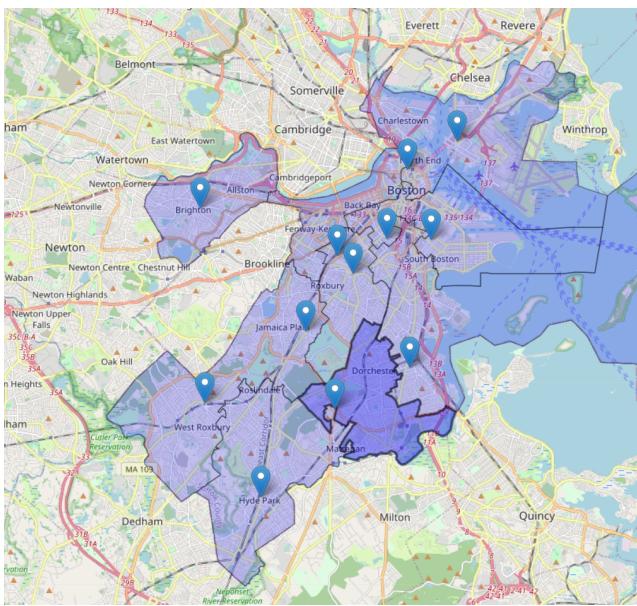
Our analysis revealed several socio-economic factors that may contribute to the violence in District 4:

- A limited number of police stations in District 4 compared to main Boston, which may facilitate criminal activity.
- Only one hospital in District 4, pointing to a potential lack of adequate health and human services.
- A single university in District 4, which might discourage high school students from aspiring to higher education and drive them towards alternative, potentially criminal, paths for income.
- A scarcity of parks and green spaces in District 4 compared to the rest of the city, which could negatively impact mental health.
- Upon examining the Field Interrogation and Observation dataset, we identified a significant pattern of gun-related violence in District 4, particularly in Dorchester, Mattapan, and parts of Jamaica Plain and Roslindale. The majority of these incidents occur during afternoon, evening, and nighttime hours, emphasizing the need for targeted interventions during these times.

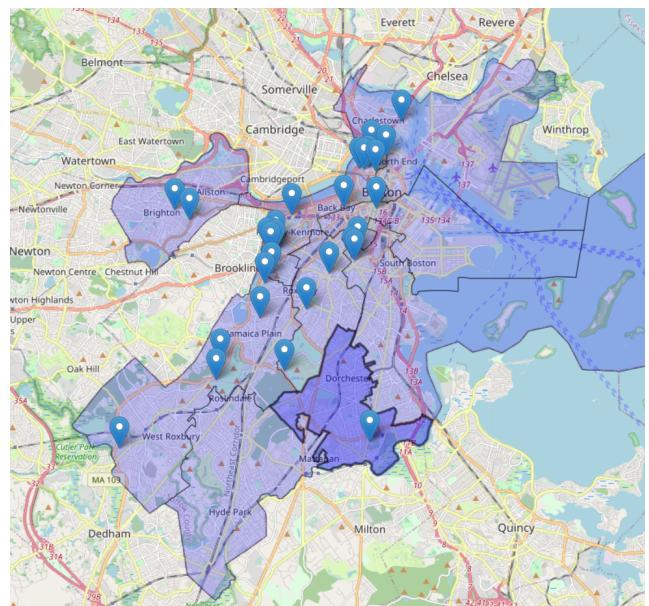
An analysis of shooting locations in relation to public transportation revealed that most shootings happen in areas further away from MBTA stops, which is consistent with the geographical distribution of District 4. In contrast, areas such as east and south Boston experience shootings mainly near MBTA stop locations.

We also found that the primary age group for suspects involved in gun-related incidents in District 4 is between 19 and 34 years old. However, Dorchester displayed a higher number of suspects under 18, indicating a concerning trend of youth involvement in gun-related violence.

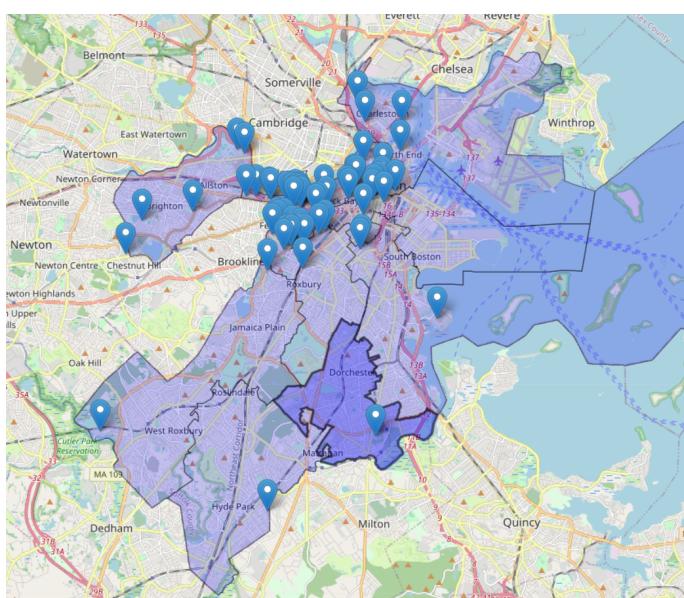
Lastly, we observed that the homicide clearance rate in District 4 has been generally decreasing from 2015 to 2020, with a brief increase in 2018 before hitting the lowest rate of 0.35 in 2020. This trend could signify a need for more effective law enforcement strategies and community engagement to address the ongoing violence in District 4.



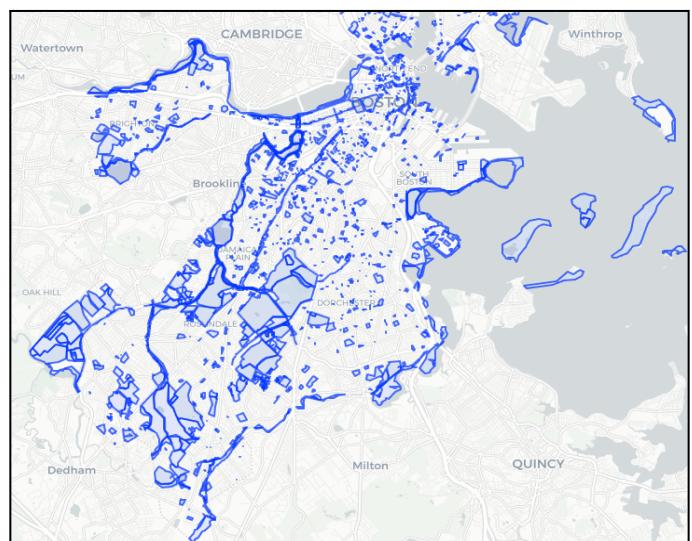
Police stations



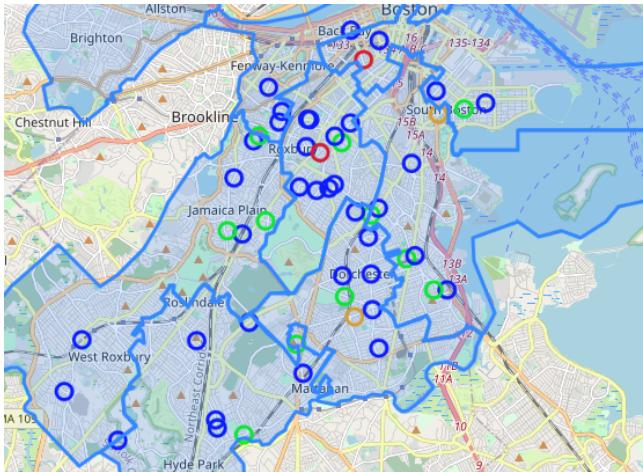
Hospitals



Colleges and universities



Parks



How we analyzed the data:

To analyze the data and understand the factors contributing to violence in District 4, we followed a systematic approach, utilizing various datasets and supplemental data sources. Our methodology is outlined below:

Data Collection: We first gathered relevant datasets, including Police Department datasets (Field Interrogation and Observation data, Shootings, Shots Fired, and Crime Incident Reports) and public transportation data (MBTA). We also collected supplemental data such as information on police districts, police stations, community centers, parks, hospitals, and universities.

Early Analysis: We conducted an initial examination of the socio-economic factors that could be related to violence in District 4. This involved comparing the availability of resources like police stations, hospitals, universities, and green spaces in District 4 to the rest of Boston.

In-depth Examination: We delved deeper into the Field Interrogation and Observation dataset to identify patterns of gun-related violence in District 4. We focused on factors such as the timing of incidents and the age of suspects involved.

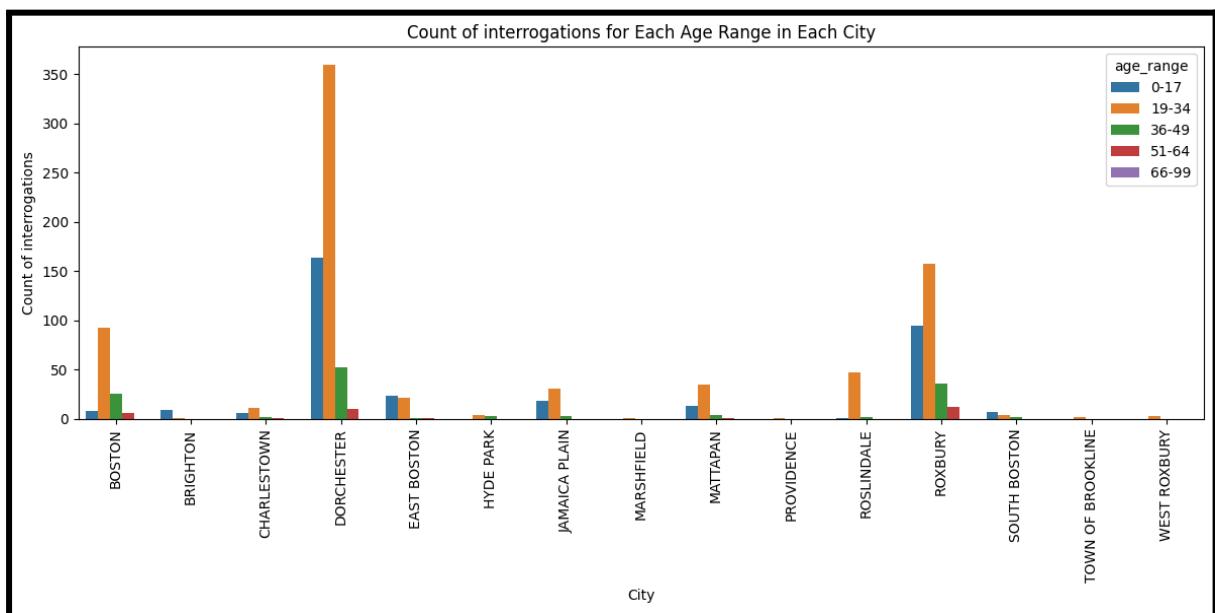
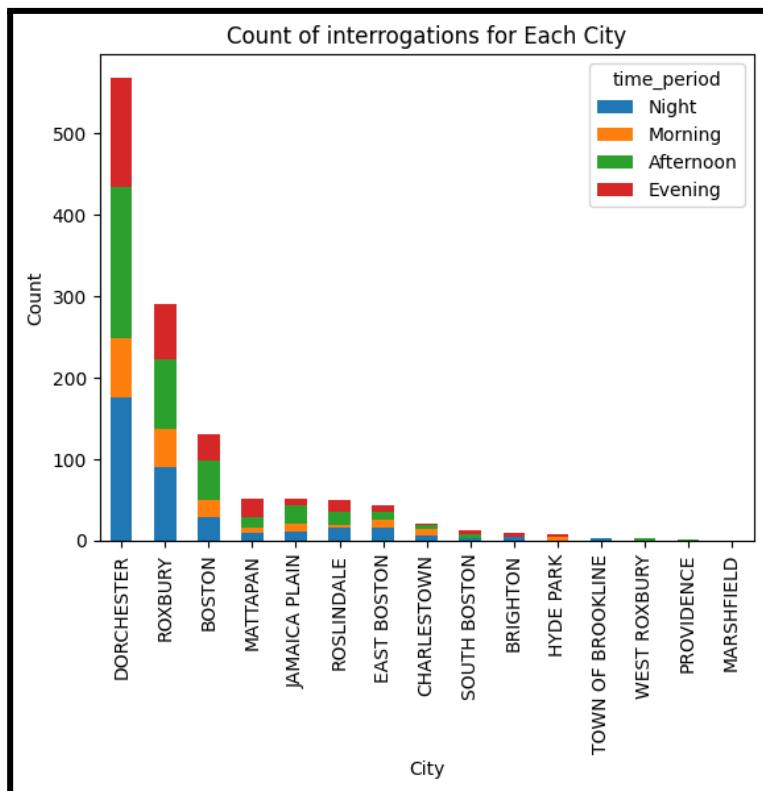
Geospatial Analysis: We analyzed shooting locations in relation to public transportation, specifically MBTA stop locations, to identify any correlations or patterns that might help explain the violence in District 4.

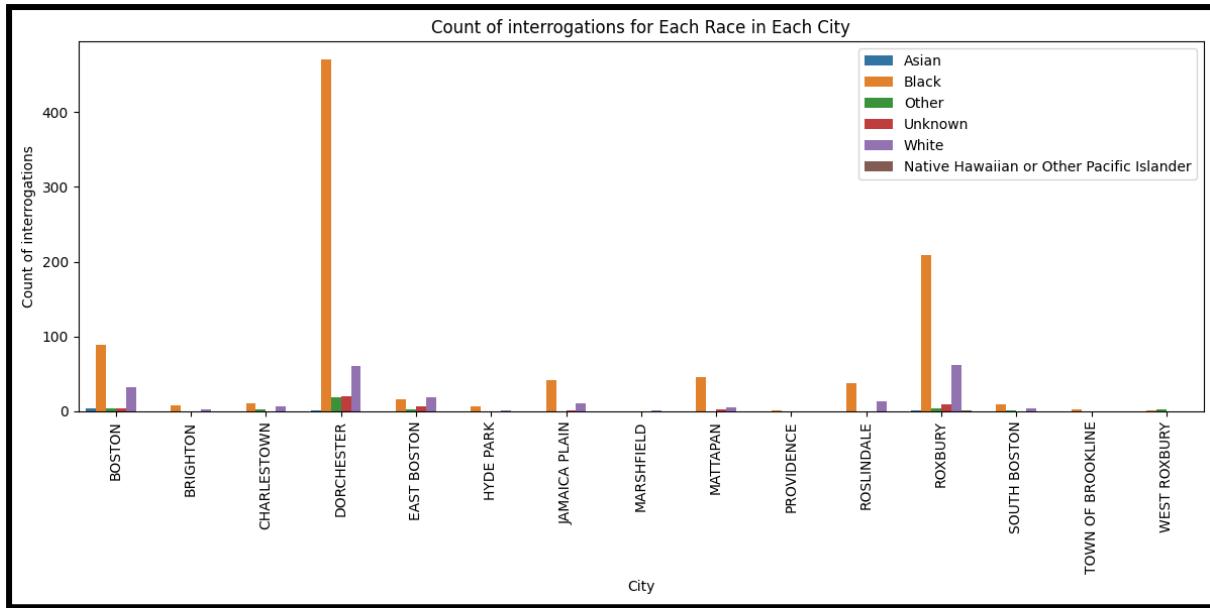
Trend Analysis: We investigated trends in the homicide clearance rate from 2015 to 2020 to understand how effective law enforcement has been in addressing violence in District 4.

Throughout our analysis, we used various data processing and visualization techniques to better understand the relationships between different factors and violence in District 4. We identified key insights, such as the prevalence of gun-related violence, the timing of incidents, the age of suspects, and the relationship between violence and public transportation.

By synthesizing the information gathered from these datasets and analyses, we were able to draw conclusions about the potential drivers of violence in District 4 and suggest targeted interventions and strategies to address these issues.

Our analysis of gun-related interrogations has revealed that the primary age group for suspects in City Council District 4, as well as throughout the city, falls between 19 and 34 years old. However, we must pay particular attention to the Dorchester neighborhood within District 4. This area exhibits a significantly higher number of suspects under the age of 18, indicating a concerning trend of youth involvement in gun-related incidents.





How does this help us answer the question :

After conducting a thorough analysis of the Field Interrogation and Observation dataset, it has come to our attention that a notable pattern of gun related violence exists within District 4. This district, which encompasses Dorchester, Mattapan, and parts of Jamaica Plain and Roslindale, experiences a significantly higher rate of firearm-related incidents compared to the rest of the city.

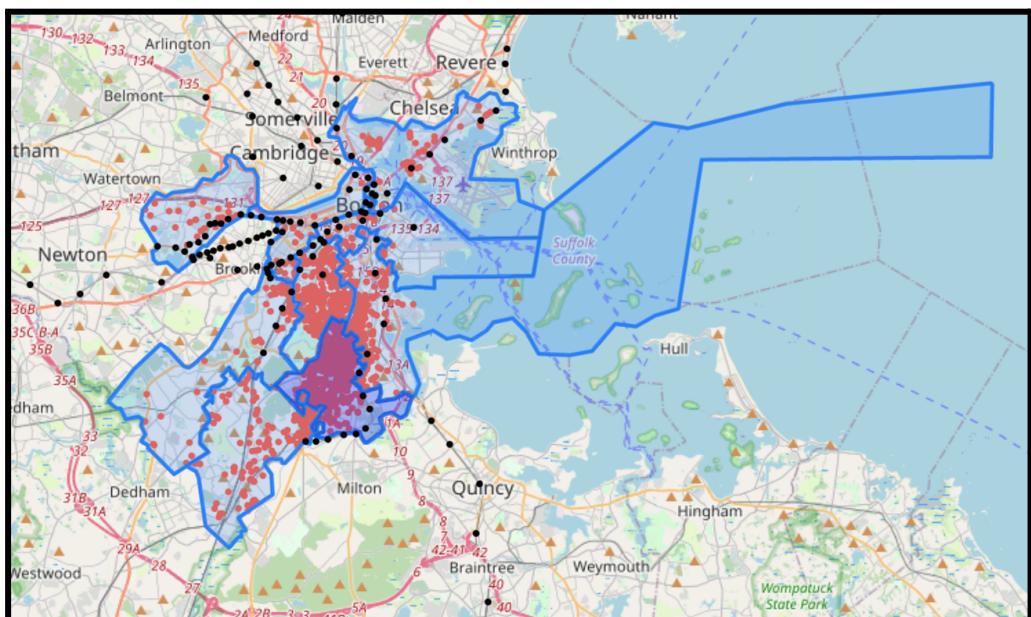
Furthermore, our analysis reveals that the majority of gun-related incidents occur during afternoon, evening and nighttime hours. This crucial insight highlights the need for targeted interventions and increased vigilance during these specific periods.

This data helps us answer the question by providing insights into the factors contributing to the violence in District 4 and identifying areas for targeted interventions. The key findings from the analysis are:

1. The prevalence of gun-related violence in District 4 compared to the rest of the city indicates that firearm-related incidents should be a primary focus when addressing violence in the district.
2. The timing of gun-related incidents (afternoon, evening, and nighttime hours) suggests that targeted interventions and increased vigilance during these periods could potentially reduce the number of violent incidents.

3. The relationship between shooting locations and their proximity to public transportation reveals an area-specific pattern in District 4, which could help law enforcement and city planners develop strategies to improve safety in these locations.
4. The age group of suspects in gun-related incidents, particularly the higher number of suspects under 18 in the Dorchester neighborhood, emphasizes the need for prevention and intervention programs targeted at young people in District 4.
5. The decreasing homicide clearance rate from 2015 to 2020 suggests a need for improved law enforcement strategies and community engagement to better address ongoing violence in District 4.
6. The inverse relationship between the number of guns recovered and the homicide clearance rate highlights a potential area for further investigation. Understanding this relationship could help identify strategies to improve the effectiveness of law enforcement in reducing violence.

By analyzing the data from various sources, we can better understand the patterns, trends, and factors associated with violence in District 4. This understanding enables the development of targeted interventions and strategies to address the root causes of violence and create safer communities.

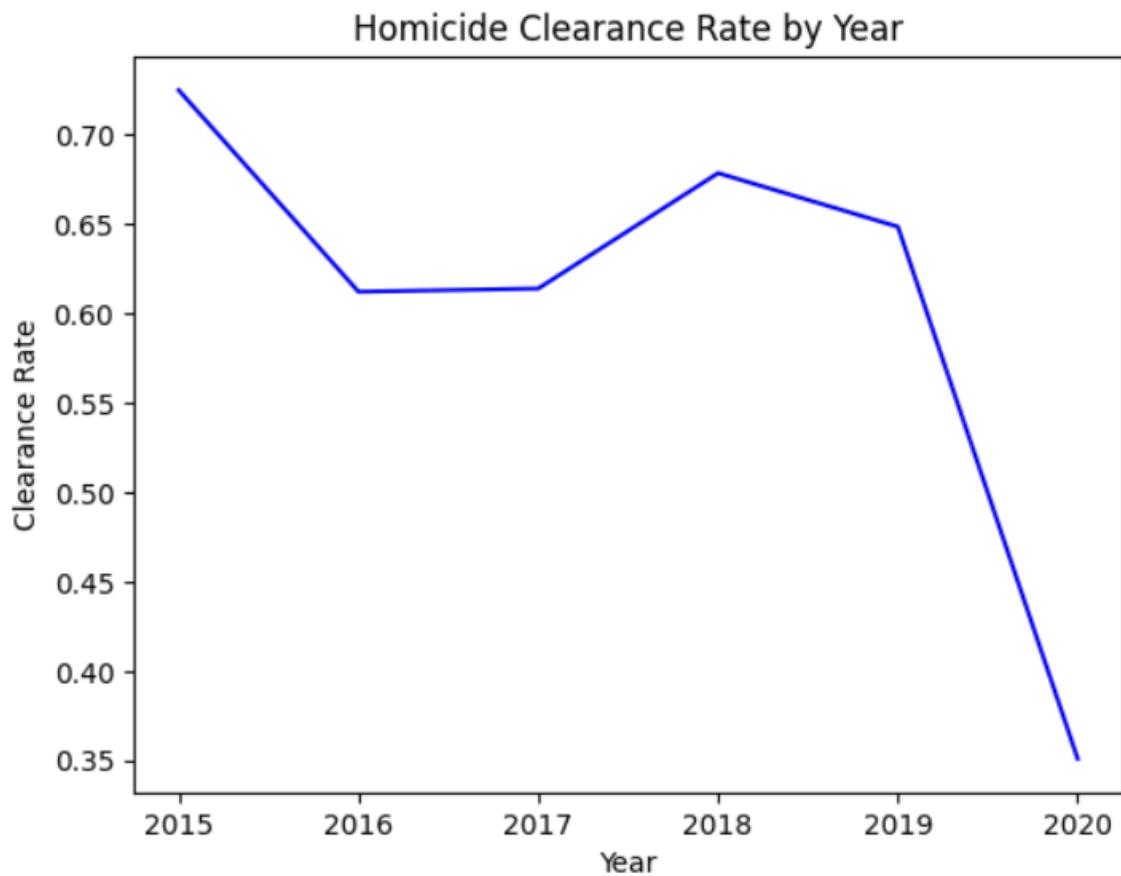


Upon further examination of shooting locations and their proximity to public transportation, specifically MBTA stop locations in Boston, we've identified a distinct pattern. The majority of shootings appear to occur in areas farther away from MBTA stops. Significantly, these

areas encompass almost the entirety of Boston City Council District 4. For other neighborhoods, for example east and south Boston, the shooting pattern is specifically near MBTA stop locations.

Homicide Clearance Rate by Year

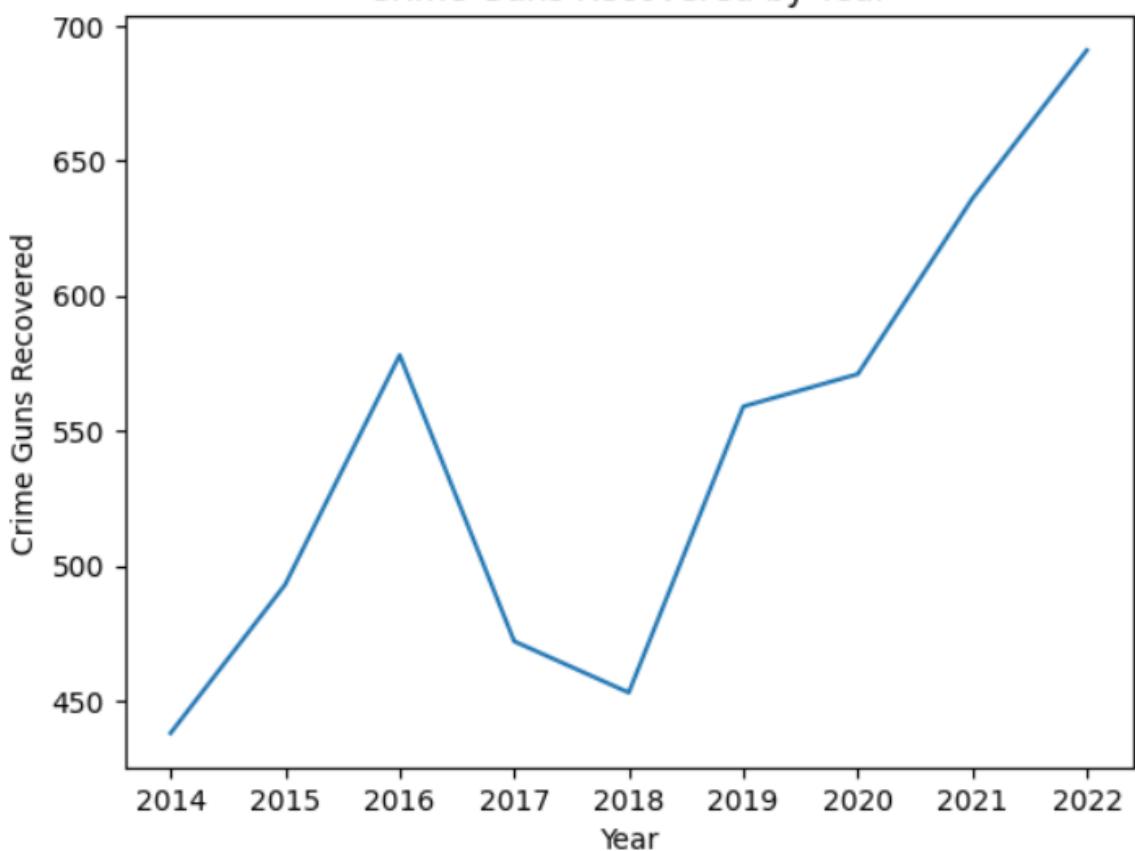
From 2015 to 2020, the rate of homicides cleared in District 4 has been generally decreasing with an uptick in 2018 of 0.68 before reaching the lowest rate of 0.35 in 2020.



Crime Guns Recovered by Year

From the chart, we can see that the number of guns recovered in District 4 is generally increasing from 2014 to 2022 with a dip in 2018 of 450 guns and the highest number of recovered guns in 2022 with just under 700 guns. It is interesting to note that the trends in the number of guns recovered and the homicide clearance rate in district 4 have an inverse relationship. When the homicide clearance rate is high, the number of guns recovered is low and vice-versa.

Crime Guns Recovered by Year



Deliverable I below:

Facts at a glance:

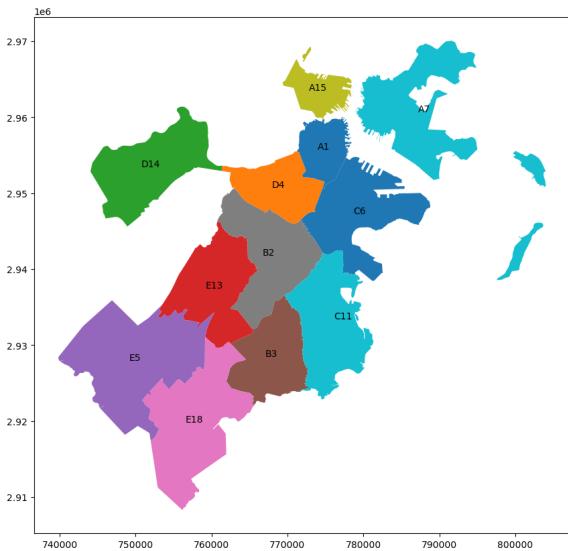
1. Total number of shooting incidents - 1798
 2. Total number of shots fired - 7555 shots
 3. Total number of deaths from shooting - 300 deaths
 4. Total number of collateral deaths - 90 deaths
 5. Most dangerous locality - B2, B3, C11 PD

Figures and graphs plotted:

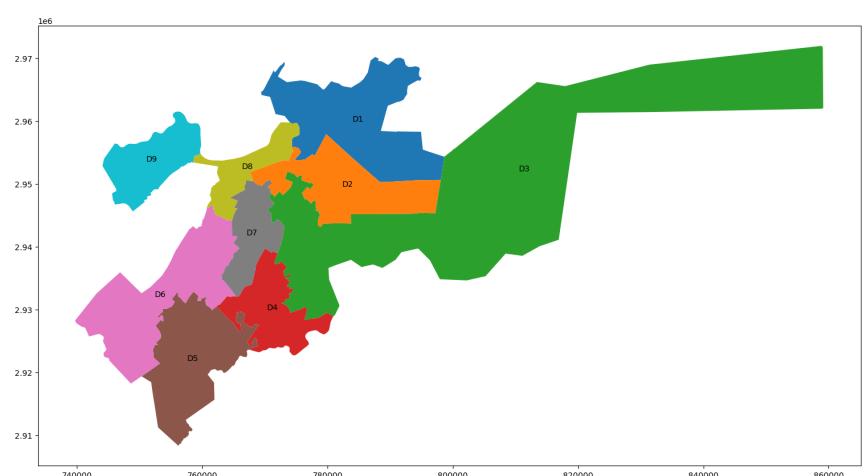
Districts in Boston

We can see D4 is made up of B3 and C11 police districts.

Map of Police Districts in Boston

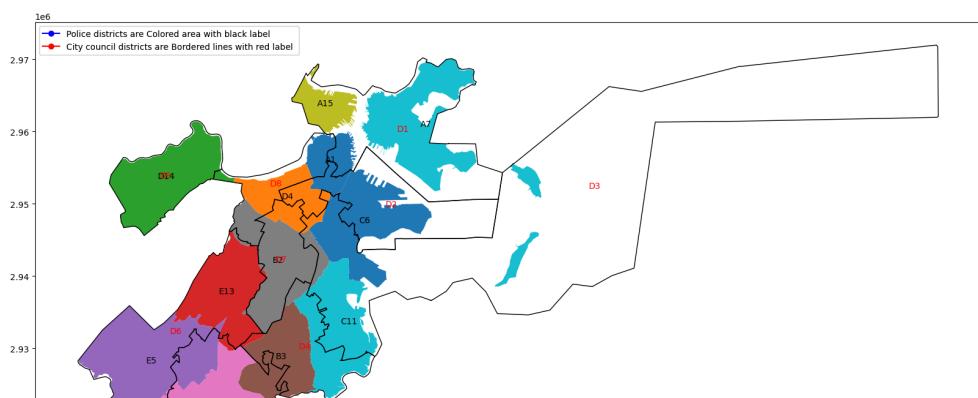


Map of Congressional Districts in Boston



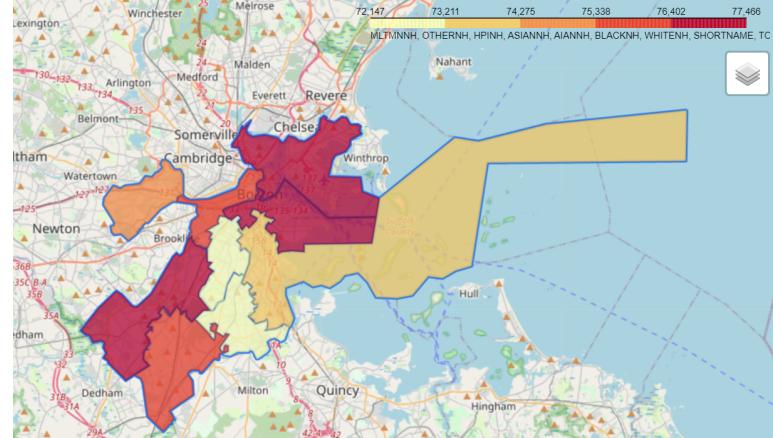
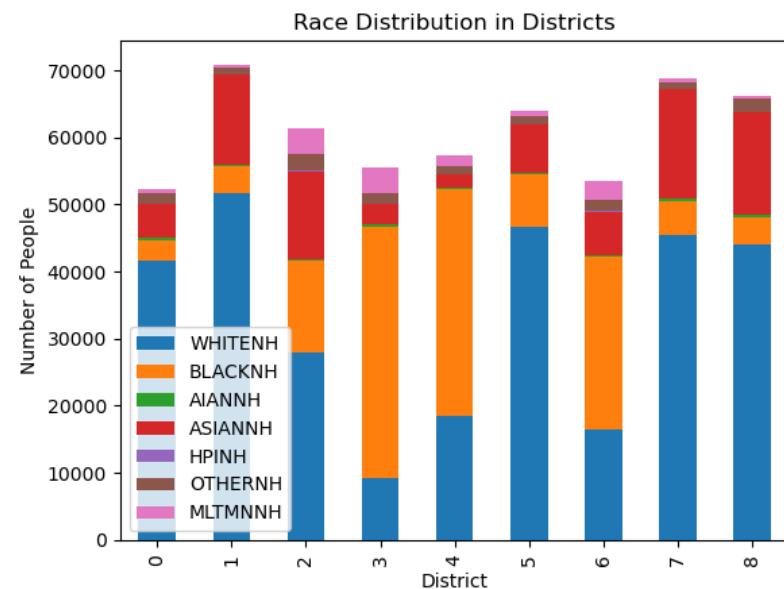
Here we can see the police districts overlaid with the congressional districts.

Overlay of Police Districts on to Congressional Districts:



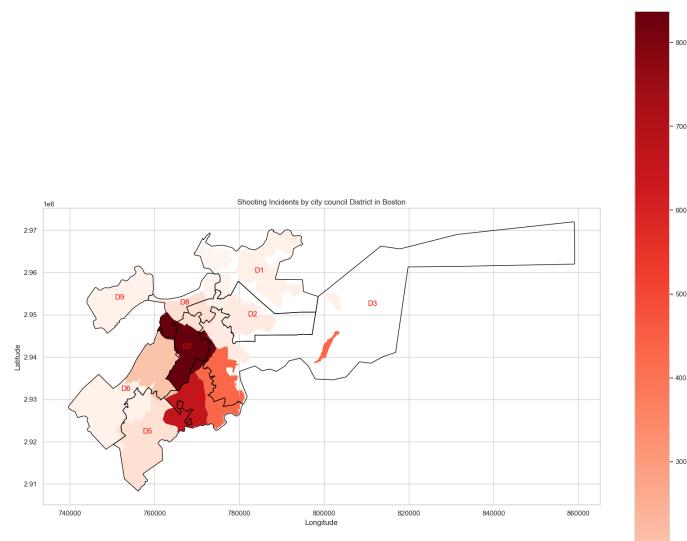
Race Distribution throughout Congressional Districts:

From the Bar graph on the left, we can visualize the demographics of Boston's congressional districts by population. The map on the right visualizes which district has the highest concentration of each race.



Shootings in Boston Congressional Districts:

The following map displays the concentration of shootings based on congressional districts. We can see that district d4 has the 2nd highest concentration of shootings when compared to the other districts.



Questions to answered:

#1: What is the rate of gun violence in District 4? How does this compare to the rest of the city?

Answer 1:

As we can see the **congressional district D4** is made up of police districts **C11 and B3** (referred to from now on as D4) where we can see based on Figure 1.1 based on the data from 2015-2023 for **shooting incidents in D4 there were a total of 1088 incidents** which took place. As for referring to Figure 1.2 D4 we can see there has been a pattern rise and fall however the median remains the same. We can also see that in terms of race affected the most and the least, **Black males were the most affected** by the shooting incidents and in terms of females, **Black females were the most affected. Asians were the least affected / non affected demographic.** White males were mildly affected and White females were mostly unaffected.

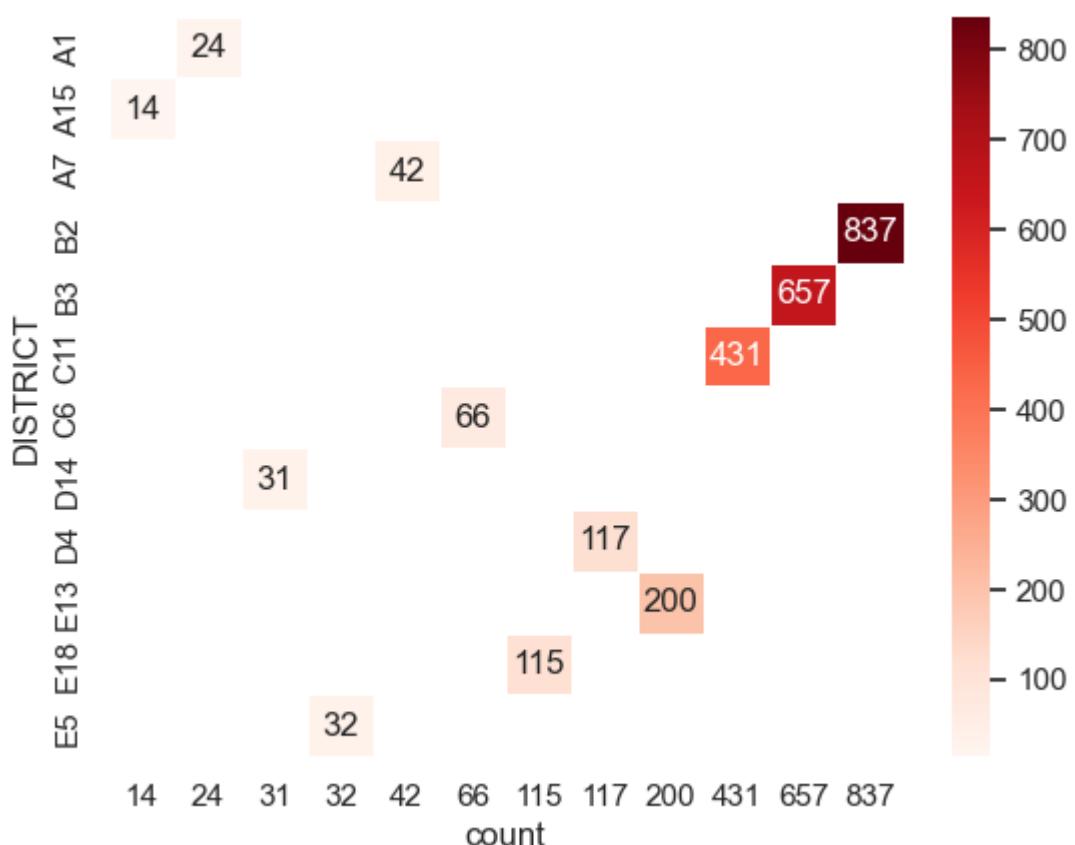


Fig. 1.1 Shooting incidents in different police districts in the year 2015 - 2023

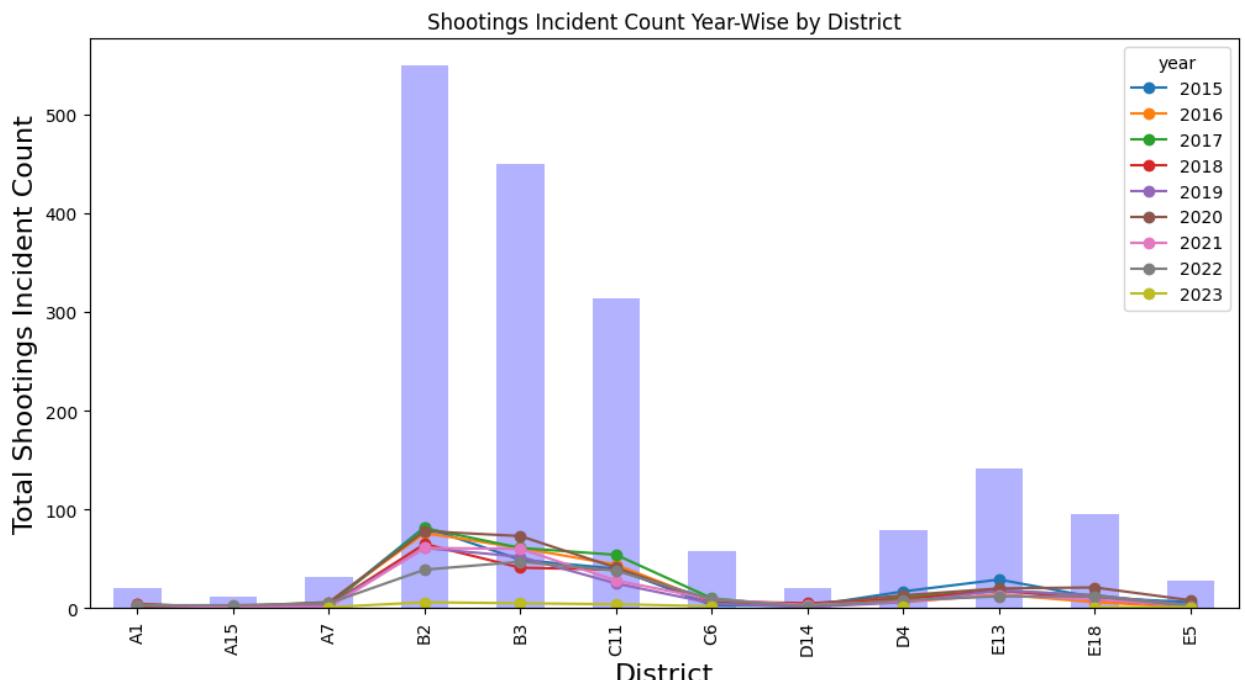


Fig. 1.2 Total shooting per district along with shootings in a particular year.

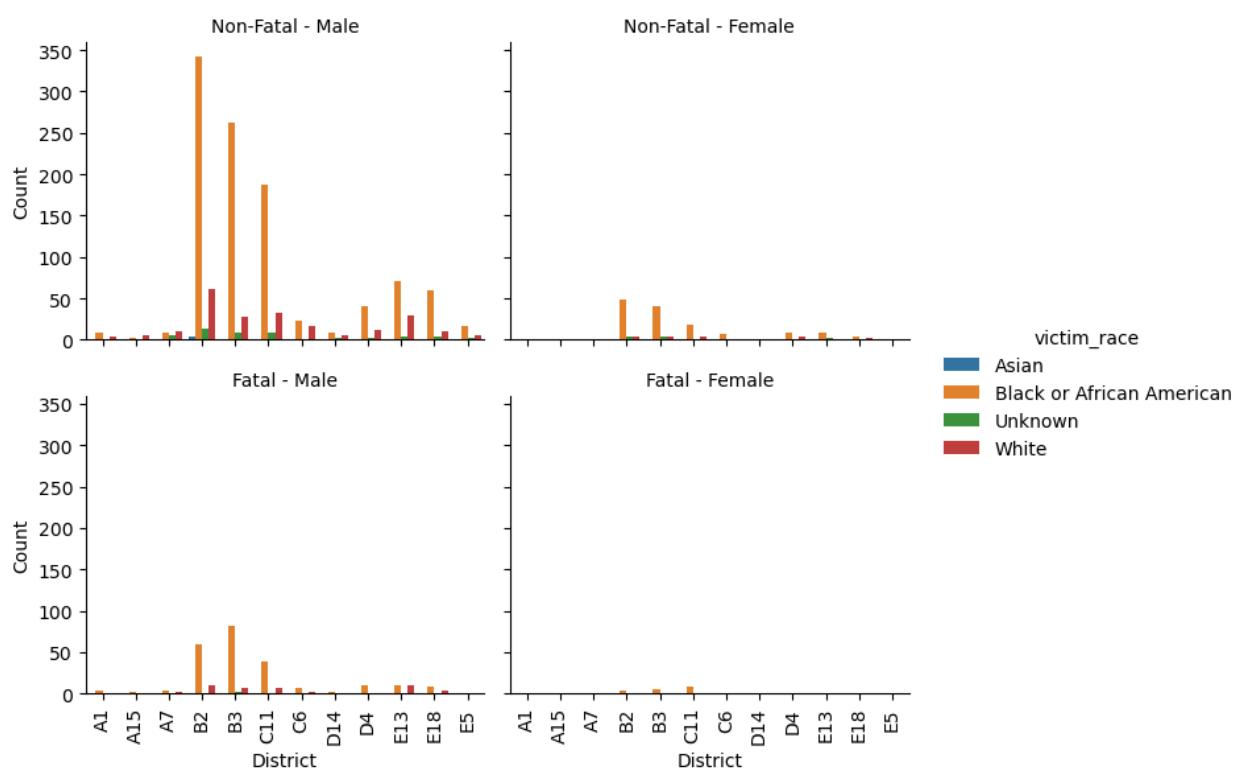


Fig. 1.3 Bar chart of victims in shooting incidents in police districts

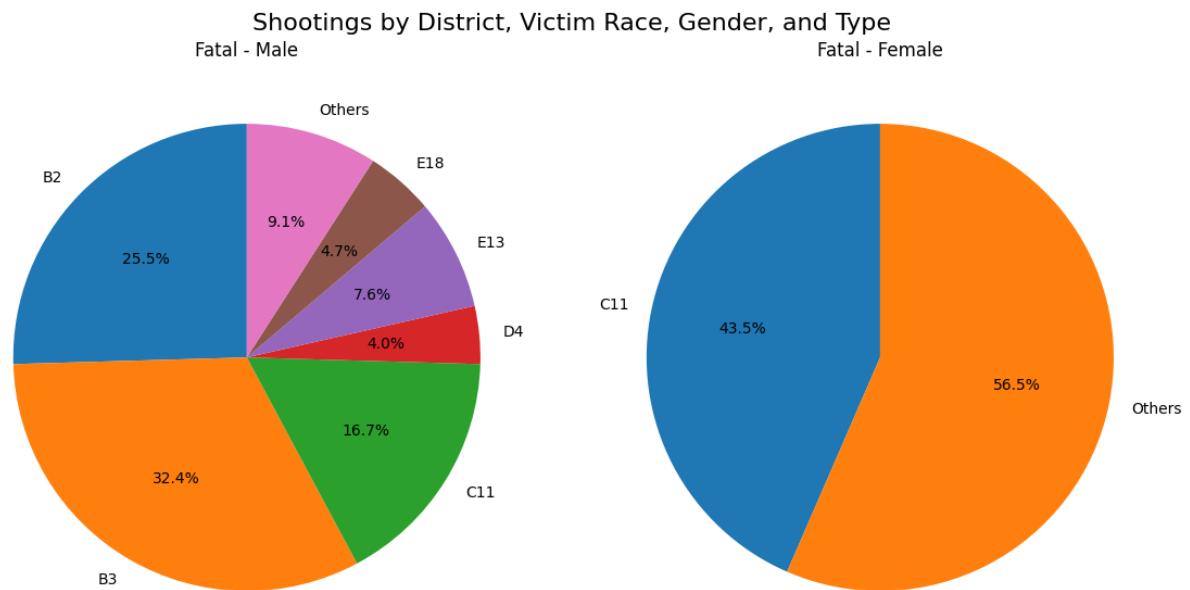


Fig. 1.4 Shootings by district, victims race, gender and fatality type

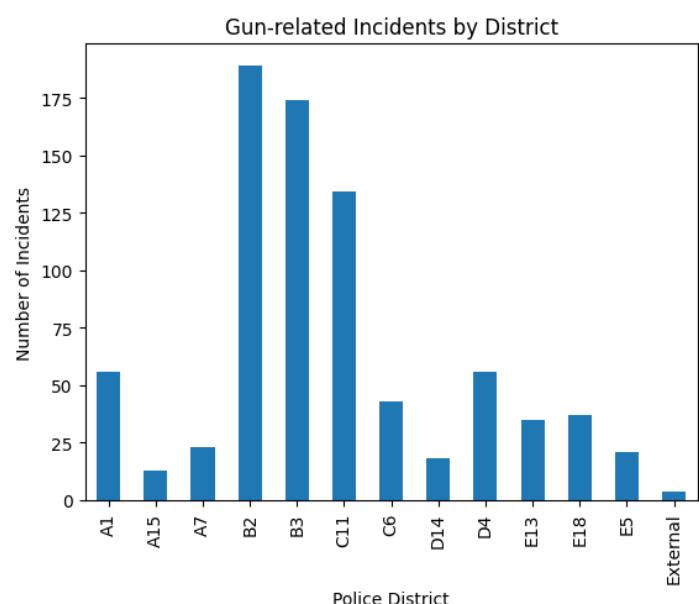
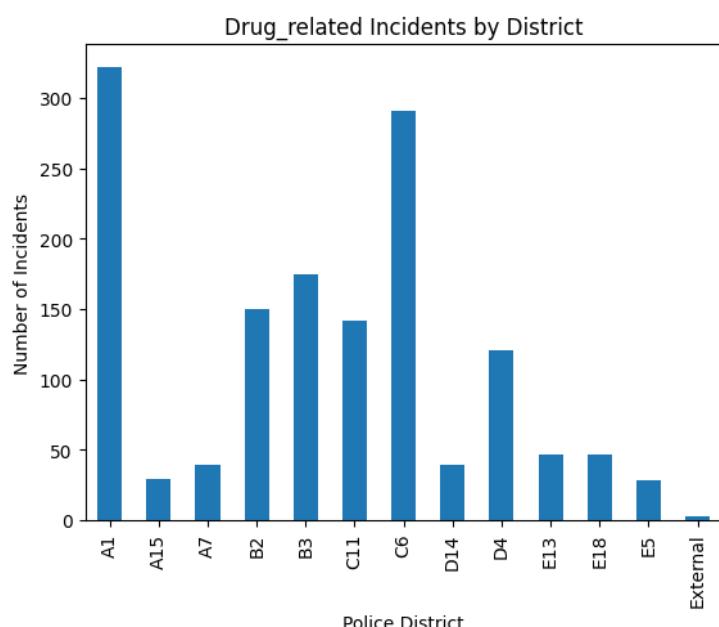
#2: Are there patterns in terms of type of violence in District 4? How does this compare to the rest of the city?

Answer 2:

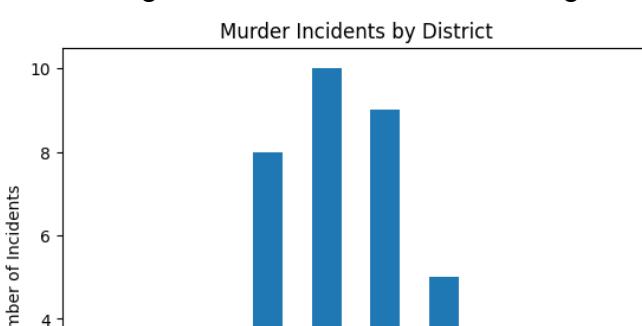
Some patterns that we can see arise in terms of type of violence include high concentrations of gun-related and murder incidents when compared to the other districts. District 4's concentrations of drug related incidents did not appear to be significantly more or less concentrated than the other districts. The variation of types of violence in district 4 appeared to be higher than that of the other districts. There did not seem to be any violence patterns among districts when comparing incidents of weapons in schools.

From the following bar graphs we can see several patterns when comparing police districts B3 and C11 (which happen to be in congressional district 4) to the other police districts. We can see that drug related incidents in B3 and C11 have the 3rd and 5th most drug related incidents respectively.

We can also see that police districts B3 and C11 have the 2nd and 3rd most gun-related incidents respectively, when compared to the other police districts.

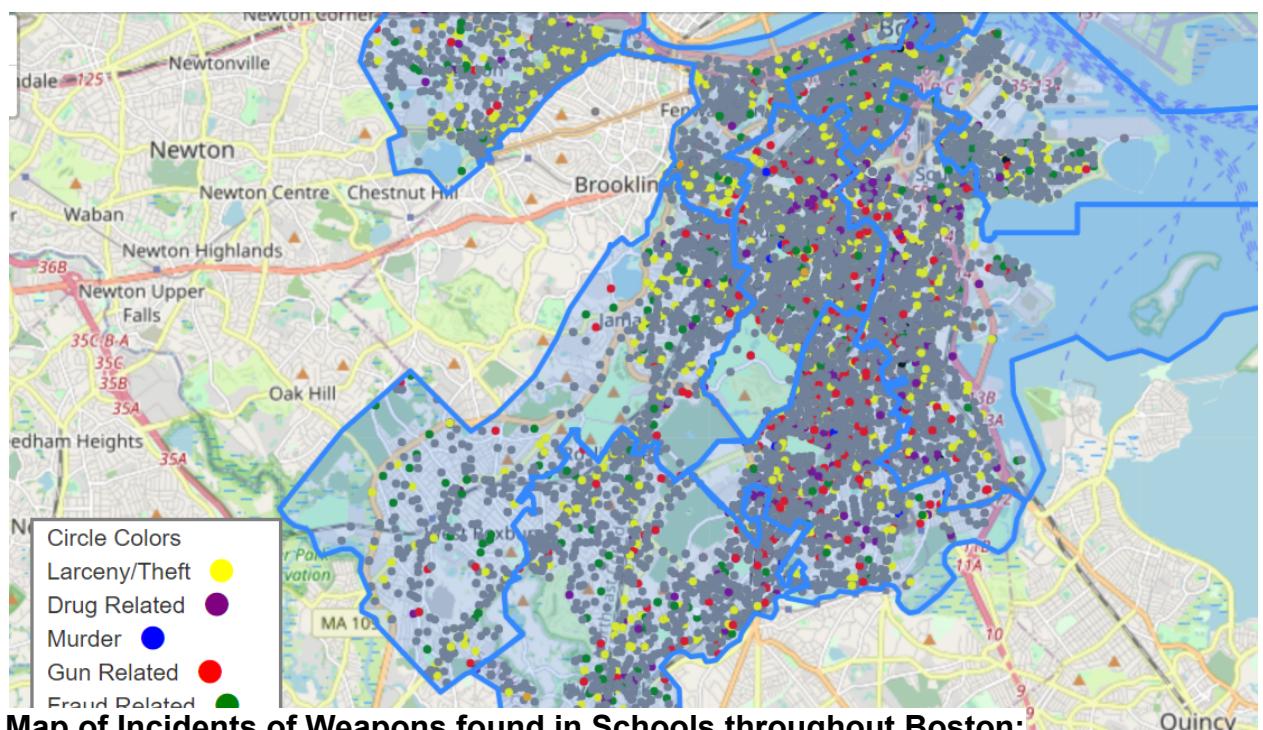


From the graph, we can see that murder incidents in districts B3 and C11 have the highest and second highest number of incidents than the other districts. This means that congressional district 4 has the highest number of murder incidents.



Map of Different Types of Violence in Boston:

The following map shows a high concentration of violent acts in the downtown Boston area as well as the District 4 area. It is interesting to note that even though the District 4 area is not the most concentrated for violent acts, there is more variation in types of violent acts in District 4 than there is in the downtown area.



Map of Incidents of Weapons found in Schools throughout Boston:

The following map shows points where there was at least one incident where a student brought a weapon on the school campus. We can see that there does not appear to be a high concentration of these incidents in District 4. Because of this, we can conclude that incidents of students bringing weapons to campus do not contribute to the patterns of violence in District 4.

