Environments and Violence

Analyzing the relationship between environments and violence in District 4

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This project analyzes the relationship between environments and violence between District 4. The environments include factors such as proximity to parks, distance to police stations, and urban heat areas. Violence includes any police-reported shooting incidents since shootings are the most common crimes that occur within Boston.

Hypotheses

Warmer areas will exhibit an increased amount of shootings

Boston exhibits characteristics of an urban heat island[1], indicating variations in temperature across different areas of the city due to architectural influences. Consequently, we hypothesized that regions with higher average temperatures around Boston would experience an increase of violence, given the anticipation of greater human presence in those locations. We also hypothesized that heat may contribute to increased tension and aggression in people.

Parks will show a negative correlation with amount of shootings

We hypothesized that parks, and areas surrounding them, may exhibit lower levels of violence due to the understanding that such environments could contribute to a reduction in violence by fostering increased community engagement, offering opportunities for leisure activities, and promoting an overall sense of well-being among residents.

The presence of community centers, BHA (Boston Housing Authority) facilities*, and police stations will have a mixed impact on shooting rates*

We hypothesized that, on one hand, the sense of community that these places foster would positively impact social interactions. On the other hand, the potential increase in foot traffic may lead to higher risk of incidents if not adequately managed. Additionally, we believed that there would be the least amount of violence at police stations as the fundamental role of police stations is ensuring public safety, thereby establishing them as hubs of security and deterrents to violence.

Methods

To put our hypotheses to the test, we looked at geographical data of community centers, parks, police stations, BHA facilities, and shooting incidents, all gathered from Analyze Boston. Using tools like ArcGIS, a mapping application, we visualized this geographical data on two maps. This geographical analysis allowed for a visual investigation of potential correlations between these elements, resulting in a thorough knowledge of how the existence of community centers, parks, BHA facilities, and police stations may relate to shooting rates in various sections of District 4. Our research aimed to improve the clarity and accessibility of our findings by using geospatial tools, allowing for a more intuitive interpretation of the complex relationships between

environmental, social, and law enforcement variables and their potential impact on community safety in Boston.
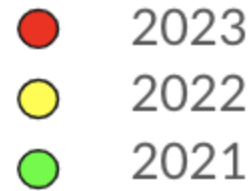
Map Key

- Focus: District 4: B3, E13, E5, C11
    - B3: Mattapan/ North Dorchester
    - E13: Jamaica Plain
    - E5: West Roxbury/ Roslindale
    - C11: Dorchester

- Violence:
    - 2021 Shootings[2]
    - 2022 Shootings[2]
    - 2023 Shootings[2]

- Environments:
    - BCYF (Boston Center for Youth and Families) Facilities Chart[3] [A]
    - Boston Parks (Open Space) Locations[4] [A]
    - Boston Police Station Locations[5] [A]
    - Boston Housing Authority (BHA) Locations[6] [A]
    - Boston Heat Map Explorer[7] [B]
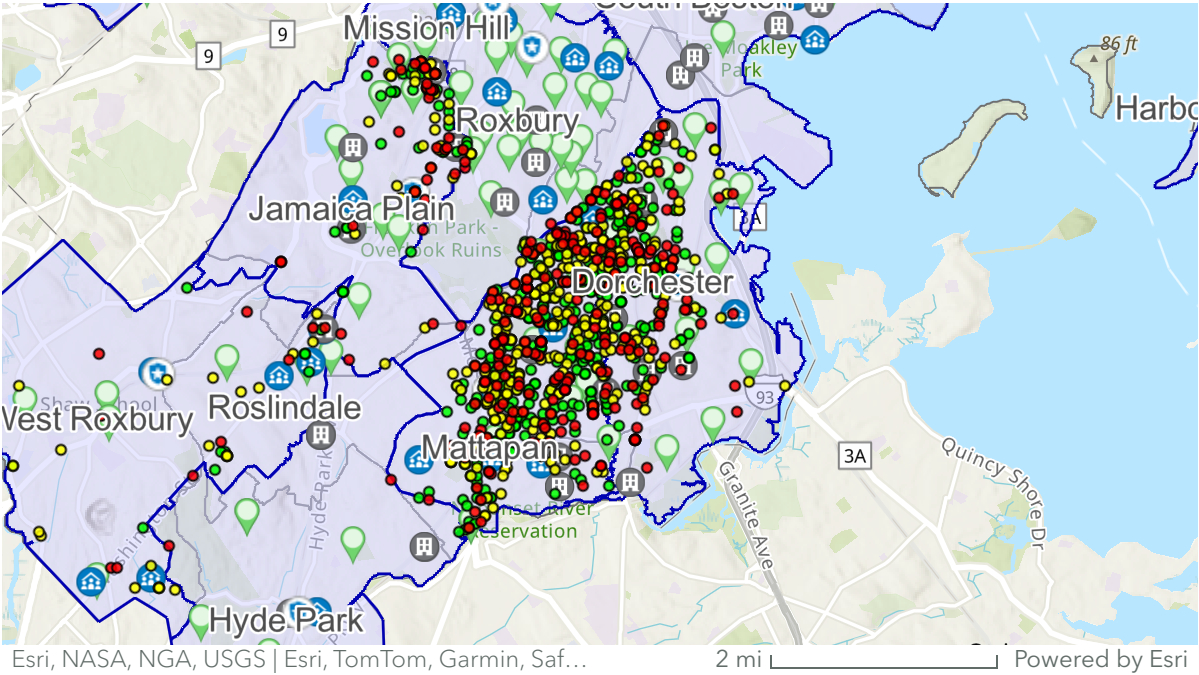
Parks

Crime Points

2023
2022
2021

Community Centers

Police Stations

BHA Locations

Visual Map Key

[A] 2021-2023 Shootings with Community Centers, BHA Locations, Parks, and Police Stations

In this map, we gain a visual insight into the correlations between the locations of shootings and their proximity to key community features such as parks, police stations, community centers, and Boston Housing Authority (BHA) locations. The spatial analysis of these incidents in relation to these community elements provides a comprehensive view, allowing for a better understanding of the geographic patterns associated with shootings and their potential connections to various community resources and facilities. This visualization aids in identifying areas where preventative measures or community-focused interventions may be particularly crucial in addressing and mitigating incidents of gun violence.

| Year					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2021	479	41.8	41.8	41.8
	2022	380	33.2	33.2	75.0
	2023	287	25.0	25.0	100.0
	Total	1146	100.0	100.0	

Number of shootings by year

Upon our initial examination of the frequency of violence in each year, we observed an overall decrease in the number of shootings from 2021 to 2023. However, it's important to note that the data from 2023 only included information up to September. Despite this limitation, we predict that there will still be a decrease in shootings compared to the previous years.

District		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	c11	397	34.6	34.6	34.6
	e13	121	10.6	10.6	45.2
	e5	50	4.4	4.4	49.6
	b3	578	50.4	50.4	100.0
	Total	1146	100.0	100.0	

Number of shootings by district

In terms of specific areas, the Mattapan/North Dorchester area experienced the highest number of shootings, accounting for 50.4% of the data. On the other hand, the West Roxbury/Roslindale district was identified as the safest among the neighborhoods.
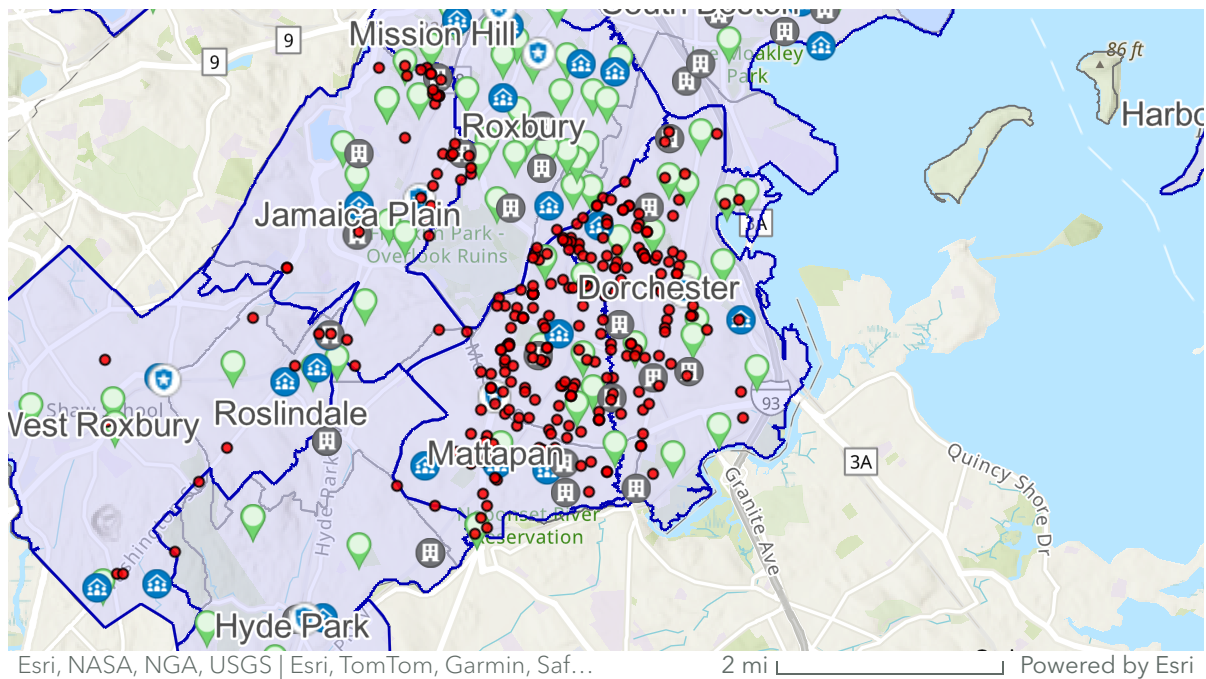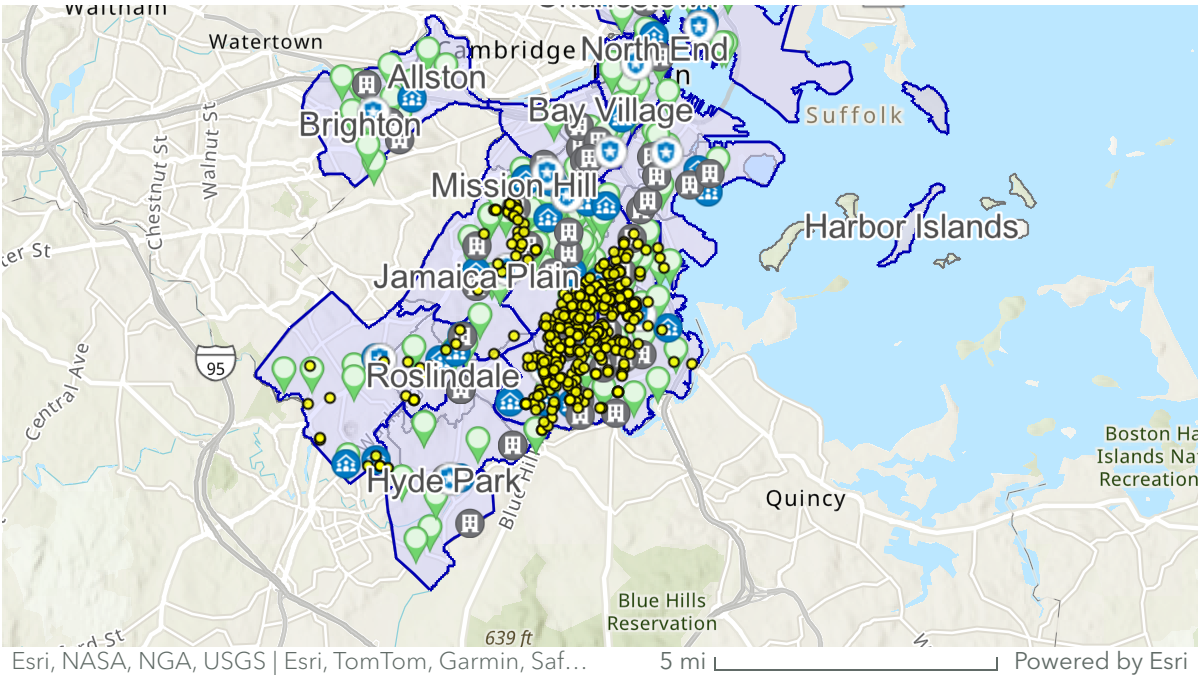
[A.1] 2023 Shootings with Community Centers, BHA Locations, Parks, and Police Stations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	c11	104	36.2	36.2	36.2
	e13	39	13.6	13.6	49.8
	e5	12	4.2	4.2	54.0
	b3	132	46.0	46.0	100.0
	Total	287	100.0	100.0	

Shootings by District[a]

a. Year = 2023

Number of shootings in 2023 by district

In the specific context of 2023, a closer examination reveals that the Mattapan/North Dorchester area and the Dorchester area collectively account for a substantial majority of the recorded shootings.
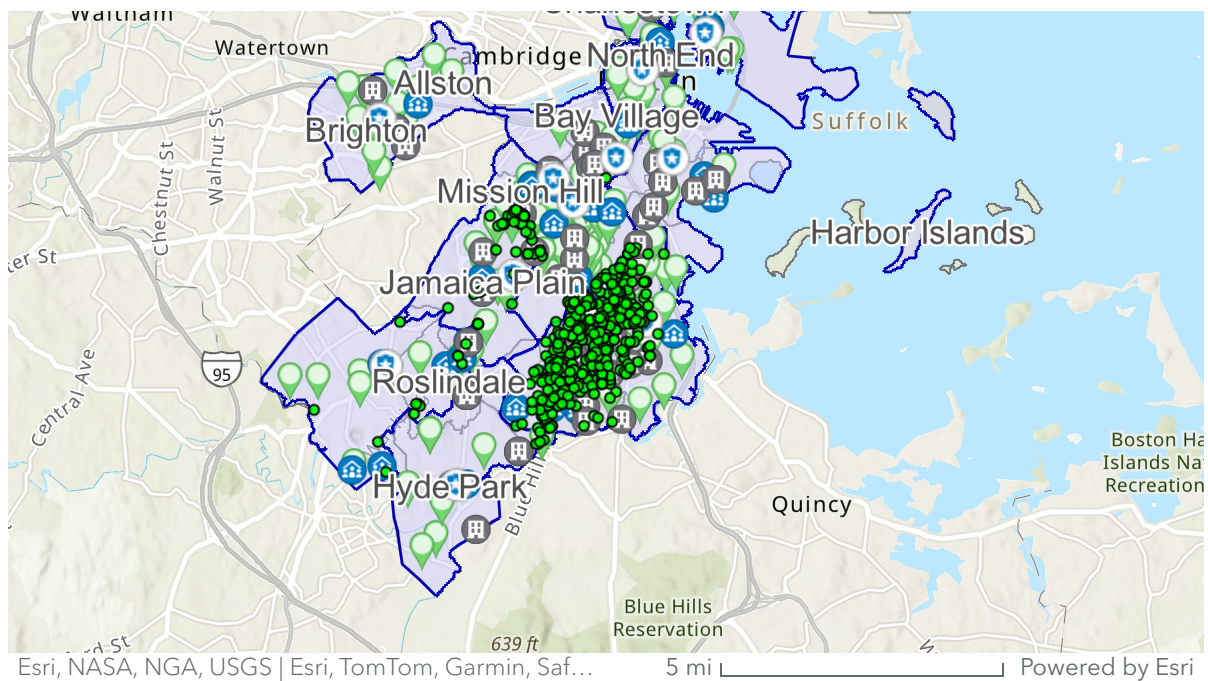
[A.2] 2022 Shootings with Community Centers, BHA Locations, Parks, and Police Stations

		Frequency	Percent	Valid Percent	Cumulative Percent
Shootings by District[a]					
Valid	c11	140	36.8	36.8	36.8
	e13	34	8.9	8.9	45.8
	e5	22	5.8	5.8	51.6
	b3	184	48.4	48.4	100.0
	Total	380	100.0	100.0	
a. Year = 2022					

Number of shootings in 2022 by district

This pattern is consistent with the data from 2022, indicating a persistent trend in these regions.

[A.3] 2021 Shootings with Community Centers, BHA Locations, Parks, and Police Stations

		Frequency	Percent	Valid Percent	Cumulative Percent
Shootings by District[a]					
Valid	c11	153	31.9	31.9	31.9
	e13	48	10.0	10.0	42.0
	e5	16	3.3	3.3	45.3
	b3	262	54.7	54.7	100.0
	Total	479	100.0	100.0	
a. Year = 2021					

Number of shootings in 2021 by district

Similarly, the trend observed in 2021 also demonstrated a continued prevalence of shootings in the Mattapan/North Dorchester and Dorchester areas, underscoring a lasting pattern over the years.
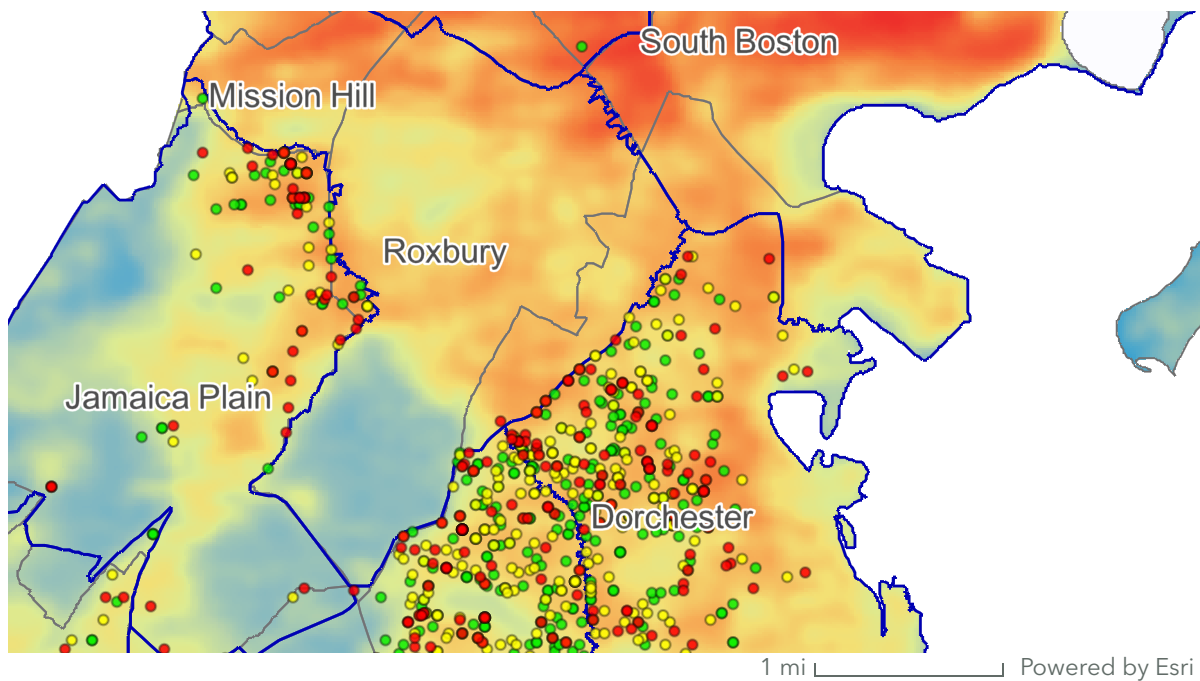
[B] 2021-2023 Shootings on Daytime Air Temperature - Heat Resilience Solutions

In this map, we have the opportunity to visualize the correlations between the occurrences of shootings and temperature. By integrating temperature data into the spatial analysis, we can identify potential patterns or trends that may exist between the incidence of shootings and varying temperature levels. This innovative approach provides a comprehensive view of the interplay between environmental factors and violent incidents, offering valuable insights for understanding the complex dynamics of such occurrences within specific geographical areas.

Findings

We reject the hypotheses as our examination failed to reveal any discernible trends or statistically significant correlations between the number of shootings and the variables under consideration. Contrary to the first hypothesis, areas with higher temperatures did not exhibit a consistent positive correlation with elevated shooting rates. Similarly, there was no evidence supporting the second hypothesis, as areas near parks did not demonstrate a clear negative correlation with the frequency of shootings. Lastly, the third hypothesis

suggesting a mixed impact of community centers, BHA facilities, and police stations on shooting rates was not substantiated by our findings.

Implications and Directions for Future Research

Given the inconclusive nature of our broader analysis, we recommend focusing future research efforts on the specific examination of Dorchester, an area with notably higher shooting prevalence. By honing in on Dorchester, we seek to unravel the intricate dynamics unique to this community, offering a more nuanced understanding of the underlying factors contributing to elevated violence rates. This targeted approach not only enables the identification of community-specific challenges but also provides a foundation for the development of tailored interventions and informed policy recommendations. The emphasis on localized research can contribute significantly to the broader goal of fostering safer and more resilient communities, shedding light on the intricacies that may be overlooked in a more generalized analysis.

In addition to our suggestion to concentrate on Dorchester for a more focused investigation, introducing a comparative analysis would deepen our research. Exploring areas with similar demographics but lower violence rates allows for a comparative perspective, providing insights into potential protective factors or successful interventions that may be applicable to Dorchester.

Moreover, considering the dynamic nature of community dynamics, it is crucial to propose longitudinal studies. Observing changes over time in violence rates and correlating them with urban development or policy changes can offer valuable information about the sustained impact of interventions and the evolving nature of violence patterns.

Furthermore, to ensure a comprehensive understanding of the unique dynamics in Dorchester, we advocate for active community engagement in the research process. This involves gathering qualitative data through interviews and surveys, enabling us to capture local perspectives, experiences, and insights directly from community members. This inclusive approach not only enriches the analysis but also ensures that interventions and policy recommendations stem from the lived realities of the residents, thereby increasing their effectiveness and relevance.

Citations

[1] https://www.boston.gov/environment-and-energy/heat-resilience-solutions-boston

[2] https://data.boston.gov/dataset/shootings

[3] https://data.boston.gov/dataset/community-centers

[4] https://data.boston.gov/dataset/open-space

[5] https://bostonopendata boston.opendata.arcgis.com/datasets/e5a0066d38ac4e2abbc79 18197a4f6af

[6] https://www.arcgis.com/home/item.html?id=dfb32eb41c6c4a3b8020cbaf004f859f

[7] https://boston.maps.arcgis.com/apps/View/index.html?appid=77e5ead45a664676b7d404d6df3d7f05&extent=-71.0996, 42.3244,-70.9606,42.3940