## **Decoding Gun Violence:**

## An Analysis of Non-Fatal Shootings in New York City, 2013 – 2023

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CRJ 593: Applied Research Project

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August 2, 2024

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## **Executive Summary**

## Introduction

In fulfillment of degree requirements for Arizona State University's M.S. program in Crime Analysis, this project analyzes recent and historic patterns of non-fatal shootings in New York City. The study period ranges from January 2013 through December 2023. Research questions aim to identify the New York City precinct with the highest rates of non-fatal shootings and to analyze geographic and temporal patterns based on its shooting hot spots.

## **Project Goals & Supporting Objectives**

This project aims to produce actionable recommendations for the NYPD and to contribute to gun violence research on non-fatal shootings in urban settings. Spatiotemporal analyses and a victim demographics analysis aim to assess gun violence patterns in the precinct most afflicted by non-fatal shootings. Suggestions are provided for tactical and strategic responses, as well as future gun violence research and focused deterrence initiatives.

### **Topic Background**

Gun violence endangers public safety, threatens community well-being, and negatively impacts national and local economies. In the state of New York, gun violence has been prioritized as one of the state's most serious problems. As government officials and law enforcement shift toward place-based, community-oriented interventions, there is a need to better understand shooting patterns in places like New York City. Much of the literature on gun violence discusses how shootings tend to concentrate in hot spots. This project aims to identify hot precincts and analyze non-fatal gun violence trends in these areas, like peak shooting periods and spatial clustering patterns.

### Methodology

Geographic analyses focused on identifying the hottest precinct for non-fatal shootings in recent years, as well as the past decade, and analyzing hot spots within this precinct based on 2023 data. Temporal analyses consisted of a threshold report and the identification of peak shooting periods based on seasonality, day of week, and time of day. A victim demographics analysis was also conducted to assess at-risk populations, though this analysis is limited due to data availability issues.

### Findings

Precinct 73 has had the highest non-fatal shooting rates in New York City for the past ten years. Precincts in the Bronx trail behind Precinct 73 by a small margin. Within Precinct 73, all shooting incidents clustered in one general area, within a 0.75-mile radius. Repeat incidents were located within five blocks of one another. Incidents occurred in a socioeconomically disadvantaged neighborhood and tended to spike during the summer months of June through August, as well as major holidays. During the summer, shootings tended to be more frequent on Tuesdays and Wednesdays, on weekends, and during the middle of the day and overnight. Black males aged 18 – 44 had the highest risk of victimization, based on available data.

## Discussion

A hot spots policing approach is recommended for Precinct 73. Patrols should be increased, and a high-visibility police presence should be implemented during peak shooting periods. A focused deterrence initiative is also recommended as a long-term violence prevention strategy to target high-risk populations and establish healthy community-stakeholder partnerships.

## Conclusion

Overall, non-fatal shootings in New York City have concentrated within a few precincts and only within small geographic areas with those precincts. Spatiotemporal analyses and other crime analysis methods are critical for identifying patterns in violent crime activity and for developing effective, targeted interventions that keep communities safe.

### **I. Introduction**

In fulfillment of degree requirements for the Master of Science in Crime Analysis program at Arizona State University, this capstone project analyzes non-fatal shooting patterns in New York City. The study period spans from January 1, 2013, through December 31, 2023.

This project aims to answer the following questions: In 2023, which police precincts in New York City reported the highest non-fatal shooting (NFS) rates? Over the past ten years, which precincts reported the highest NFS rates, and how do these trends compare to those in 2023? Based on these findings, which precinct has been most affected by persistently high levels of NFS incidents, and what kinds of spatiotemporal patterns can be observed from its shooting hot spots?

The purpose of these research questions is to identify which NYPD precinct has had the highest non-fatal shooting rates in 2023 and over the past ten years, to analyze geographic and temporal patterns of non-fatal shootings within this precinct, and to provide recommendations to the NYPD for tactical and strategic responses. In addition to the NYPD, my secondary target audience is gun violence researchers. As will be discussed shortly, there is a notable research gap concerning non-fatal shootings, which should be addressed because studying gun violence beyond the context of firearm homicides could lead to a more comprehensive understanding of violent crime and inform stronger prevention strategies.

After an overview of project goals in Part II of this paper, Part III will provide background information on the prevalence and socio-economic impacts of non-fatal shootings, as well as a brief overview of gun violence literature pertaining to shooting hot spots, high-risk populations, and peak shooting periods. Part IV will discuss project methodology, while Part V will report findings from spatiotemporal and victim demographic analyses. In Part VI, project findings will be placed within the context of evidence-based intervention strategies to provide actionable recommendations to the New York City Police Department (NYPD). Study limitations and recommendations for future gun violence research will also be discussed.

### **II. Main Goals & Supporting Objectives**

This project's main goals are to provide the NYPD with actionable recommendations for the prevention of non-fatal shootings in its most afflicted precinct and to contribute to research on non-fatal gun violence in urban settings. The objectives are as follows: (1) analyze data on NFS incidents to identify police precincts with the highest rates of gun violence in 2023; (2) conduct a 10-year trend analysis to determine which of these precincts have had persistently high NFS rates between 2013 and 2023; (3) identify the precinct with the highest, most persistent NFS rates over time; and (4) assess gun violence patterns within this precinct through geographic, temporal, and victim demographics analyses.

The primary focus of the fourth objective is to assess recent spatiotemporal patterns based on 2023 data to inform law enforcement where and when NFS incidents tend to occur most frequently. The geographic analysis seeks to identify street-level hot spots and any clustering patterns, while the temporal analysis seeks to identify peak shooting periods. An analysis of victim demographics will also be included to provide insight into populations with increased risk of gun violence victimization.

### **III. Issue Background**

### Gun Violence in America & the Research Gap Regarding Non-Fatal Shootings

Gun violence continues to be a serious problem for communities across the United States, often resulting in tragic outcomes like premature death, physical disability, and mental illness. As of 2022, firearm-related injuries were one of the five leading causes of death for Americans between the ages of 1 to 44 (Centers for Disease Control and Prevention, 2024). In response to the growing crisis, New York issued the nation's first executive order that classified gun violence as a statewide emergency in 2021 (New York State Department of Health, 2023). In June 2024, the Office of the U.S. Surgeon General (2024) followed suit by declaring gun violence a national public health crisis. Although many institutions, like New York's Office of Gun Violence Prevention, strive to develop effective, evidence-based interventions to combat this problem, a number of gaps exist in gun violence literature that warrant further attention. If addressed, they may lead to additional insights on violent crime patterns and inform the development of future intervention strategies.

One such research gap is the scarcity of analyses on non-fatal shootings. This is largely due to a widespread lack of local law enforcement efforts to systematically track NFS incidents, which may be attributed to the absence of a nationally accepted definition for non-fatal shootings and the fact that there is no federal requirement to report NFS incidents (National Police Foundation, 2018; Office of U.S. Surgeon General, 2024; Research Triangle Institute, 2023). As many have noted, fatal shootings tend to be the focus of political and media attention, even though non-fatal shootings are at least two to four times more likely to occur (Centers for Disease Control and Prevention, 2024; Fowler et al., 2015; Hipple et al., 2020; Hipple, 2022; Johns Hopkins Center for Gun Violence Solutions, 2020; Kaufman et al., 2020).

Additionally, clearance rates for NFS incidents have been consistently low for police departments across the United States, which reinforces the need for more NFS research to inform strategies for violence prevention programs (Research Triangle Institute, 2023). In particular, researchers have called for local-level improvements in the collection, tracking, and analysis of NFS incident data for the purpose of developing a more nuanced understanding of the prevalence and spatiotemporal distribution of violent crime (Hipple, 2022; Research Triangle Institute, 2023).

### **Socio-Economic Consequences of Non-Fatal Shootings**

Non-fatal shootings may not result in immediate death, but there are serious physical, mental, and economic consequences that may pose lasting risks to survivors and society at large. Although chronic shootings are generally limited to hot spots, the publicization and fear of gun violence can have ripple effects that impact the health and financial stability of entire regions.

Prior research indicates that physical safety largely depends on people's proximity to shooting hot spots and the degree to which they are involved in risky social networks. Many studies have noted that a majority of city shootings occur in a small number of areas – typically in socioeconomically disadvantaged neighborhoods – and are perpetrated by a small portion of the city's overall population (Braga et al., 2010; Fox & Novak, 2018; Papachristos et al., 2015; Rowlands & Love, 2022; Smith et al., 2024; Weisburd et al., 2004). Although these findings imply that physical risk is limited to certain areas and populations, serious mental health problems can spread more easily through a community as a result of gun violence exposure.

For instance, Vasan et al. (2021) found that up to two months after a shooting incident, children were more likely to visit pediatric emergency rooms for acute mental health symptoms if they lived within six blocks of a known shooting location. The authors noted that the probability of these visits increased as the distance between the child's home and the shooting location decreased. Other studies have also suggested statistically significant correlations between indirect shooting exposure and American youth's mental health diagnoses, especially for anxiety, depression, trauma disorders, and self-harming behaviors (Buggs et al., 2022; Oddo et al., 2021; Office of U.S. Surgeon General, 2024).

Even for residents who live far from hot spot neighborhoods, merely seeing signs of disorder or learning about isolated crime incidents through news and social media outlets has the potential to distort their perceptions of crime, influence work-leisure activities, and impact a city's overall economic health. In an interview survey of residents and business leaders in New York and three other cities, Love and Loh (2023) found that perceived levels of violent crime in downtown areas were significantly greater than the actual number of crimes. The study's respondents cited heightened perceptions of crime and fears for personal safety as the primary reasons they would not return to downtown areas – a factor that has hindered the economic recovery of multiple cities post-pandemic (Love & Loh, 2023).

Aside from regional revenue loss, chronic shootings also translate into substantial financial costs for national and state economies. According to Everytown Research & Policy (2022), the aftermath of non-fatal gun violence amounts to an average annual cost of \$557 billion nationwide, which impacts survivors, taxpayers, and businesses alike. In the state of New York, the average annual cost is \$11.4 billion (New York State Department of Health, 2023). Some of these costs consist of patient transportation, treatment for physical injuries and trauma-related mental disorders, employee disability, law enforcement investigations, criminal prosecutions, and incarceration (Everytown Research & Policy, 2022). As a result, gun violence impacts nearly all sectors of American society.

### Literature Review: Shooting Hot Spots, High-Risk Populations, & Peak Shooting Periods

Several studies have noted that the majority of shootings in major cities occur in a small number of areas (i.e., hot spots) and are perpetrated by a small percentage of the overall population, particularly by members of high-risk social networks (Braga et al., 2010; Fox & Novak, 2018; Rowlands & Love, 2022; Smith et al., 2024; Weisburd et al., 2004). For instance, over a 29-year period, Braga et al. (2010) found that more than half of all gun violence in Boston occurred at less than 3% of the city's street segments and intersections. In Chicago, Papachristos et al. (2015) found that 70% of all non-fatal gunshot victims were part of co-offending networks, which made up less than 6% of the total population. Moreover, the authors noted that an individual's likelihood of victimization increased dramatically as their exposure to gunshot victims increased. In other words, just as shootings tend to concentrate in hot spots, the risk of victimization may also concentrate in social networks, especially those that engage in criminal behaviors.

Taking a closer look at victim-offender demographics, Kegler et al. (2021) found a strong association between high shooting rates and high levels of urbanization, poverty, and race variables. In particular, the authors found that non-Hispanic Blacks living in poor urban neighborhoods had the highest risk for gun violence. Others have similarly identified Black males between the ages of 15–34 as a high-risk population (Johns Hopkins Center for Gun Violence Solutions, 2020; Office of U.S. Surgeon General, 2024; Papachristos et al., 2015).

In regard to temporal analyses in gun violence literature, Reeping and Hemingway (2020) cited a lack of research on peak shooting periods and seasonality trends. To address this gap, the authors analyzed shooting data in Chicago from 2012 to 2016 and found a statistically significant relationship between shooting rates and warmer temperatures, weekends, and holidays, including summer break. In particular, Reeping and Hemingway (2020) noted that when average temperatures rose by 10 degrees Celsius, shootings increased by 34% on weekdays and 42% on weekends and holidays. The authors attributed this to an increase in offending opportunities when more people were outside, as well as strong correlations between warmer temperatures, increased aggression, and higher counts of violent crime – as other studies have demonstrated

(Anderson et al., 2000; Butke & Sheridan, 2010; Cotton, 1986; Kieltyka et al., 2016; Lyons et al., 2022; Michel et al., 2016).

More recently, Klerman et al. (2024) conducted a study on peak periods for gunshot events in major American cities and found similar results. In particular, their findings indicated that shootings occurred most often during summer months, on weekends, and around holidays. Additionally, they found a statistically significant increase in shootings during the nighttime hours of 6 PM – 5:59 AM. In this project, recent and historic data will be used to determine whether similar temporal patterns can be observed in New York City's hottest precinct for nonfatal shootings.

### **IV. Project Methodology**

### **Data Source and Analysis Approach**

This project used an open-source dataset provided by the New York City Police Department (2024), which contains all reported shootings in New York City from 2006 through 2023. For the purposes of this report, all non-fatal shootings that occurred from January 1, 2013, through December 31, 2023, were extracted from the original dataset. Since a main project goal is to produce recommendations for the NYPD, incidents were analyzed on the level of police precincts. Accordingly, a shapefile of NYPD precinct boundaries – provided by the City of New York (2024A) – was used for choropleth mapping purposes.

In this project, geographic analyses focused on identifying the hottest precinct for nonfatal shootings in recent years, as well as the past decade, and analyzing hot spots within this precinct based on 2023 data. Temporal analyses consisted of a threshold report and the identification of peak shooting periods based on seasonality, day of week, and time of day. A victim demographics analysis was also conducted, although there are inherent limitations associated with this analysis due to data availability issues – as discussed in the next subsection.

### **Data Management Process & Main Variables**

Before the original dataset was cleaned, a preliminary analysis was performed to understand what types of insights could be drawn from the available data and which programs could be used. At this stage, Pivot Tables and Chart functions in Excel were used, as well as Attribute Table functions in ArcGIS Pro and Tableau Public. For subsequent tasks related to data management, analysis, and mapping, Excel was used primarily for tabular data analysis and data visualizations, while Tableau Public was used for crime mapping.

After exploring the dataset, a set of research questions were developed, and the following variables were identified for project use: occurrence date, occurrence time, borough, police precinct, the statistical murder flag (i.e., the value indicating whether the incident was fatal or non-fatal), victim age, victim sex, victim race, and latitude-longitude coordinates of shooting locations. To prepare this dataset for temporal analyses, a new field was added based on the date variable to specify which day of the week incidents occurred, and the time variable was reformatted to specify the hour.

Incidents which occurred outside the study period were removed, as were offender demographics data. An analysis of offender data would have contributed greatly to this project because the identification of high-risk offending populations would have provided the NYPD with useful insights on appropriate target populations for tactical and strategic interventions. Unfortunately, offender demographics data was very scarce in this dataset and could not be used. However, victim demographics were available for 53% of incidents in the precinct with the highest NFS rates. Although there are major caveats to using incomplete data, victim demographics data was used to develop a baseline understanding of at-risk victim populations in the precinct under study. Nonetheless, it should be noted that results from these analyses do not provide a complete picture of victimization trends.

### **Identifying Hot Precincts, Hot Spots, & Peak Shooting Periods**

When identifying hot precincts for non-fatal shootings, the number of incidents and the rate of shootings were both assessed. Since raw counts of shooting incidents are heavily influenced by an area's population size, solely relying on this measure to gauge problem severity may have led to misleading results. Therefore, NFS rates were calculated to normalize for any differences in population size across police precincts. Rates were based on the number of non-fatal shootings per 100,000 residents and were calculated using precinct-level population data, accessed via Infoshare Online (2024) – an open-source data repository that originally collected this data from the 2014 – 2018 American Community Survey (U.S. Census Bureau, 2019).

Choropleth maps were created using Tableau Public to assess which precincts had relatively high NFS counts in 2023 and over the past ten years. After identifying these precincts, NFS rates were calculated across both study periods. Lastly, the precinct with the highest rate across both periods was chosen for closer spatiotemporal analyses.

For the geographic analysis at this stage, NFS data from 2023 was used to detect recent patterns of gun violence activity and to provide the NYPD with the most relevant and up-to-date recommendations as possible. Using Tableau Public, a graduated symbol map was created to illustrate the distribution of NFS locations, identify repeat incident locations, and assess environmental characteristics of repeat incident hot spots.

As for temporal analyses, Excel's Pivot Table and Chart functions were used to analyze peak shooting periods. Yearly and seasonal trends were assessed using NFS data from January

2018 through December 2023. Day of week and hourly trends were assessed using NFS data from January - December 2023. These analyses assessed weekends, daytime hours, and nighttime hours based on definitions set by Klerman et al. (2024). Therefore, weekends consisted of Fridays, Saturdays, and Sundays; daytime hours were defined as 6 AM - 5:59 PM; and nighttime hours were defined as 6 PM - 5:59 AM.

#### V. Findings

New York City is made up of five boroughs and contains 77 police precincts, whose boundaries reflect actual neighborhood boundaries (City of New York, 2024B). The following analyses examine precinct-level NFS trends in 2023 and for the 2013-2023 study period. Based on these findings, most incidents have occurred in the Bronx and Brooklyn, although the incidents have not been equally distributed throughout. Rather, they have clustered in a few precincts in both boroughs. On average, two to four precincts were responsible for the majority of NFS incidents in the Bronx and Brooklyn, as well as the greater New York City region. Additionally, the precinct chosen for closer spatiotemporal analysis has experienced the highest NFS rates across both study periods.

#### Non-Fatal Shootings in New York City, 2023

In 2023, there was a total of 990 non-fatal shooting (NFS) incidents in New York City. Across all precincts, the number of incidents ranged from 1 to 61, with the greatest number of incidents occurring in Precincts 44 and 46 in the Bronx and Precincts 73 and 75 in Brooklyn. Based on Figure 1, relatively high shooting counts also appear to affect areas immediately surrounding these precincts.



Hot Precincts Based on Number of Non-Fatal Shootings in New York City, 2023

Note. Numerical labels denote police precincts.

In 2023, NFS rates across all precincts ranged from a low of 0.8 incidents per 100,000 residents (Precinct 111 in Queens) to a high of 49.3 incidents per 100,000 residents (Precinct 73 in Brooklyn). Of the top five precincts with the highest NFS rates, Precinct 73 was followed by four other precincts in the Bronx by a relatively small margin. In particular, Precinct 46 trailed behind Precinct 73 by only 4%. Furthermore, when averaging NFS rates of all precincts in each of the five boroughs, the Bronx had the highest average of 25.3 incidents per 100,000 residents, and Brooklyn had the second highest average of 13.7 incidents per 100,000 residents.

Table: Top 5 NYC Precincts with the Highest Non-Fatal Shooting Rates in 2023

Precinct	Neighborhood	Neighborhood Borough	
73	Ocean Hill-Brownsville	Brooklyn	49.31
46	University Heights	Bronx	47.53
48	Fordham	Bronx	42.16
40	Mott Haven/Melrose	Bronx	35.92
44	Morris Heights	Bronx	33.69

### Figure 3

Bar Chart: Top 5 NYC Precincts with the Highest Non-Fatal Shooting Rates in 2023



### Non-Fatal Shootings in New York City, 2013 - 2023

From January 2013 through December 2023, there was a total of 12,333 non-fatal shooting incidents in New York City. During this ten-year period, Brooklyn's Precinct 75 reported a record high of 661 NFS incidents, closely followed by neighboring Precincts 73 and 67 with totals of 635 and 532, respectively. The next hottest precincts for non-fatal shootings based on incident count were Precincts 44, 46, and 40 in the Bronx. As shown in Figure 4, these precincts are all positioned adjacent to one another in Brooklyn and the Bronx, which raises the question of whether a social contagion effect is present – as mentioned by Brantingham et al. (2021).

When comparing non-fatal shooting counts in 2023 to the aggregated totals from 2013 through 2023, high levels of NFS incidents concentrate in roughly the same areas – namely, in Precincts 67, 73, and 75 in Brooklyn and in Precincts 40, 44, and 46 in the Bronx (see Figure 4). Overall, the geographic distribution of NFS incidents during this ten-year period closely resembles the distribution seen in 2023, except NFS levels across Brooklyn precincts are not as severe in 2023 as they have been in the past. This could potentially reflect the success of recent gun violence interventions, but program evaluations would need to confirm.

### Figure 4



NYC Hot Precincts Based on Number of Non-Fatal Shootings, 2013 – 2023

Note. Numerical labels denote police precinct.

Taking a closer look at the past decade, Brooklyn and the Bronx still dominate the top ten list of precincts with the highest NFS rates (see Figure 5). Again, Brooklyn's Precinct 73 maintains the highest incident rate with 745 shootings per 100,000 residents. The second highest historical rate belongs to Precinct 42 in the Bronx, but Precinct 73's incident rate exceeds that of

Precinct 42 by 64%.

### Figure 5

Table: Top 10 NYC Precincts with the Highest Non-Fatal Shooting Rates, 2013 - 2023

Precinct	Neighborhood	Borough	Number of Incidents	Rate of Non-Fatal Shootings per 100,000 Residents		
75	East New York	Brooklyn	661	355.96		
73	Ocean Hill-Brownsville	Brooklyn	635	745.59		
67	East Flatbush	Brooklyn	532	349.84		
44	Morris Heights	Bronx	500	336.9		
46	University Heights	Bronx	434	338.14		
40	Mott Haven/Melrose	Bronx	429	440.24		
47	Eastchester	Bronx	412	247.01		
42	Tremont	Bronx	395	453.49		
79	Bedford-Stuyvesant	Brooklyn	395	405.29		
48	Fordham	Bronx	360	410.16		

#### A Closer Look at Recent Shooting Trends in Precinct 73

## Geographic Analysis of 2023 Hot Spots

Based on recent and historical NFS rates, non-fatal gun violence has been most problematic in Precinct 73. In 2023, 42 non-fatal shootings and 6 fatal shootings were reported in the area. In other words, non-fatal shootings made up 88% of all reported gun violence incidents in Precinct 73 last year.

Based on data from the City of New York (2024C), Precinct 73 – otherwise known as the neighborhood of Ocean Hill-Brownsville – has a high concentration of government-subsidized, multi-family dwellings, although there are also some privately-owned, one- to two-family homes. The median household income is approximately \$30,000, and about 40% of the total population receives some form of income support. In terms of racial composition, 80% of the population is Black, 18% is Hispanic, and 2% is of other descent.

In 2023, all non-fatal shootings in Precinct 73 clustered in one general area (see Figure 6). From the center of this hot spot zone, all incidents fell within a 0.75-mile radius. Shooting

locations generally occurred at or near low-income apartment complexes, public parking lots,

bus stops, and subway stations.

## Figure 6

Spatial Distribution of All Non-Fatal Shootings in Precinct 73, 2023



Repeat incidents occurred at five locations located in the southern sector of Precinct 73, which is the Brownsville end of the neighborhood (see Figure 7). They were all located within five blocks of each other and on the following streets: Dumont Avenue, Chester Street, Livonia Avenue, and Mother Gaston Boulevard. Two of these hot spot locations were low-income apartment complexes: Marcus Garvey Village on Chester Street and the Van Dyke Houses on Dumont Avenue. It is noteworthy that there were six other shootings within about a one-block radius of Marcus Garvey Village.



## Close-Up View of NFS Hot Spots for Repeat Incidents in Precinct 73, 2023

## **Temporal Patterns of Non-Fatal Shootings in Precinct 73**

As shown in Figure 8, the number of non-fatal shootings began trending upward since 2018 and reached a record high at the height of the pandemic in 2020. Within this two-year period, non-fatal shootings in Precinct 73 increased by 289%. However, since 2020, NFS incidents have been trending downward and have largely returned to pre-pandemic levels. In 2023, there were 79 non-fatal shootings, which was a 48% decrease from the previous 3-year average of 151 incidents.



Annual Counts of Non-Fatal Shooting Incidents in Precinct 73, 2018 – 2023

To add context to yearly incident counts between 2018 and 2023, a threshold analysis was conducted to determine what constituted as normal levels of non-fatal shootings in Precinct 73 (see Figure 9). The annual average for this six-year period was 109 NFS incidents, and the annual standard deviation was 45.7. Based on these values, 63 to 155 non-fatal shootings per year would be considered normal for Precinct 73. 19 to 62 non-fatal shootings per year would be considered below average, while any annual count fewer than 19 incidents would be considered very low. Alternatively, yearly totals between 156 and 198 would be considered above average, and yearly totals greater than 198 would be considered very high.



Threshold Analysis: Yearly Comparison of Total NFS Incidents in Precinct 73, 2018 – 2023

*Note.* 68% of all cases fall within +/-1 standard deviations of the mean, which comprises the normal range for annual NFS totals in Precinct 73. Values between +/-1 and 1.96 standard deviations are considered above or below average. Values that fall beyond +/-1.96 standard deviations are considered very high or very low.

Based on results from Figure 9, 2018 had a below-average total of 47 non-fatal shootings. In 2019, the number of incidents rose by 66% but still fell within the normal range. 2020 was the only year that reported an above-average total of 183 incidents. However, it should be noted that many communities across the United States also reported surges in violent crime during this pandemic year (Gramlich, 2021). Since then, yearly counts have been trending downward. Although the combined average for NFS incidents in 2021 and 2022 was approximately 42% greater than that of 2019 and 2023, all four years fell within the normal range. Moreover, there were no cases of exceptionally high or low annual counts during this six-year period.

Despite the sharp increase in NFS incidents in 2020 and the subsequent downward trend, seasonal shooting patterns between 2018 and 2023 have remained largely consistent. As shown in Figures 10 and 11, the past six years have experienced a spike in NFS incidents during the

summer months of June, July, and August. There have also been increased shootings during the holiday months of October, November, and December, although incident counts during this period are generally not as high compared to the summer months. Furthermore, a closer look at the data shows that more incidents have occurred on or near major holidays, especially Memorial Day, July 4<sup>th</sup>, Thanksgiving, Christmas, and New Year's Eve.

## Figure 10

Annual & Monthly Totals for Non-Fatal Shootings in Precinct 73, 2018-2023

	January	February	March	April	May	June	July	August	September	October	November	December	Yearly Totals
2018	1	0	4	2	7	4	6	5	5	3	6	4	47
2019	2	2	2	2	0	8	9	6	2	3	0	4	78
2020	1	0	4	3	3	17	19	18	10	6	5	6	183
2021	3	6	6	3	7	6	4	11	6	9	7	3	139
2022	4	6	6	3	7	6	14	6	7	3	1	4	130
2023	5	0	4	2	3	2	8	4	0	8	2	4	79
<b>Monthly Totals</b>	16	14	26	15	27	43	60	50	30	32	21	25	

## Figure 11

Monthly Counts of Non-Fatal Shooting Incidents in Precinct 73, 2018-2023



From 2019 through 2022, Precinct 73 experienced more NFS incidents between June and August compared to the period between October and December. However, in 2023, there were

14 NFS incidents reported during both periods, with the highest number of incidents occurring in July and October.

Taking a closer look at the peak shooting period between June and August 2023, incidents occurred most frequently on Tuesdays and Wednesdays, followed by Saturdays and Sundays (see Figures 12 and 13). Additionally, shootings tended to occur between the hours of 8 AM - 3 PM and 9 PM - 2 AM (see Figures 12 and 14). 50% of all NFS incidents occurred during daytime hours, and 50% occurred during nighttime hours. This stands in contrast to the period between October through December 2023, where 36% of all NFS incidents occurred during daytime hours, and 64% occurred during nighttime hours (see Figures 15 and 17). The increased percentage in daytime incidents during the summer months may be attributed to a potential relationship between warmer temperatures, increased aggression, and increased probabilities of violent crime – as cited by other researchers (Anderson et al., 2000; Butke & Sheridan, 2010; Cotton, 1986; Kieltyka et al., 2016; Klerman et al., 2024; Lyons et al., 2022; Michel et al., 2016; Reeping & Hemingway, 2020).

### Figure 12

NFS Incident Counts Based on Day of Week & Hour of Day in Precinct 73, June – August 2023

Hour of Shooting	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
0:00	0	0	0	0	0	1	0
1:00	0	0	1	0	0	0	0
2:00	0	0	2	0	0	1	0
3:00	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0
5:00	0	0	0	0	0	0	0
6:00	0	0	0	0	0	0	0
7:00	0	0	0	0	0	0	0
8:00	0	1	0	0	0	0	1
9:00	0	0	0	0	0	0	0
10:00	0	0	0	0	0	0	0
11:00	0	0	0	0	0	0	0
12:00	0	1	0	0	0	0	1
13:00	1	0	0	0	0	0	0
14:00	0	0	0	0	0	0	0
15:00	0	2	0	0	0	0	0
16:00	0	0	0	0	0	0	0
17:00	0	0	0	0	0	0	0
18:00	0	0	0	0	0	0	0
19:00	0	0	0	0	0	0	0
20:00	0	0	0	0	0	0	0
21:00	0	1	0	0	0	0	0
22:00	0	0	0	0	0	0	0
23:00	0	0	0	0	1	0	0



NFS Incident Counts Based on Day of Week in Precinct 73, June – August 2023

## Figure 14

NFS Incident Counts Based on Hour of Day in Precinct 73, June – August 2023



In contrast to the summer's peak shooting days (i.e., Tuesdays and Wednesdays, followed by weekends), October through December 2023 reported the most shootings on Mondays and Tuesdays, followed by Wednesdays, Thursdays, Fridays, and Sundays (see Figures 15 and 16). There were no reported NFS incidents on Saturdays during this period. Although both summer and fall peak shooting periods reported the same number of non-fatal shootings, incidents were distributed more evenly throughout the week during the fall period. As illustrated in Figures 15 and 17, 64% of incidents between October and December occurred during nighttime hours, which supports the finding made by Klerman et al. (2024) that city shootings tend to occur more frequently overnight.

## Figure 15

NFS Incident Counts Based on Day & Hour in Precinct 73, October – December 2023



## Figure 16

NFS Incident Counts Based on Day of Week in Precinct 73, October – December 2023





NFS Incident Counts Based on Hour of Day in Precinct 73, October – December 2023

### Victim Demographics in Precinct 73

As previously mentioned, the available data on victim demographics for 2023 NFS incidents in Precinct 73 only accounts for 53% of all incidents. With this in mind, the counts and percentages in the following analyses are based on data from a little over half of all victims and should only be used to develop a broad sense of victim demographics. Interventions that target at-risk populations will need to rely on more rigorous assessments of victim-offender demographics.

Based on available data, 98% of NFS victims were Black, while 2% were Hispanic. As for gender composition, 86% of victims were male, and 14% were female (see Figure 18). As shown in Figure 19, these individuals were distributed among various age groups, ranging from younger than 18 years old to 65 and older. In 2023, 45% of all documented victims were aged 25 to 44. The group with the second highest number of victims – 18- to 24-year-olds – accounted for 31% of all documented victims.



Gender Ratios of NFS Victims in Precinct 73, 2023

## Figure 19

Age Distribution of NFS Victims in Precinct 73, 2023



Reeping and Hemingway (2020) have suggested that observed increases in shootings during summer months may be partially due to more people being outside because school is not in session. To determine whether students (i.e., individuals younger than 18 years of age) were more likely to be victimized during the summer, victim demographics were analyzed for two peak shooting periods in 2023: June through August and October through December. As mentioned, both periods reported the same number of NFS incidents in 2023. One victim younger than 18 years old was reported during the summer period, but no victims from this age group were reported in the fall period (see Figures 20 and 21). More strikingly, across both periods, the majority of victims were aged 18 to 44 years old. From June through August, 72% of all documented victims belonged to this age range. From October through December, this percentage increased to 93% of all documented victims. Based on these findings, it appears that individuals younger than 18 do not have as much risk for gun victimization as 18- to 44-year-olds. However, this assertion is based on partial data concerning victims. Analyzing offender data would be a stronger way to determine the extent to which youth are actively engaging in gun violence.

### Figure 20







Age Distribution of NFS Victims in Precinct 73, October – December 2023

### **VI.** Discussion

### **NYPD Policy Recommendations**

The majority of gun violence across New York City's five boroughs occurs in Brooklyn and the Bronx. As of 2023, Precinct 73 in Brooklyn had the highest NFS rate in New York City, and this has been the case for the past decade. Although neighboring Precincts 75 and 67 have also reported high levels of incidents, six other precincts in the Bronx reported comparatively higher NFS rates in 2023. In particular, Precincts 48, 46, 44, and 40 in the Bronx ranked in the top five for non-fatal shootings in 2023, closely trailing behind Precinct 73 in Brooklyn. It is suggested that law enforcement in these areas continue to develop short- and long-term strategies for gun violence prevention. The following recommendations for tactical and strategic responses are tailored to Precinct 73, but they can be adapted to other areas based on respective findings from spatiotemporal analyses.

### Tactical Response: Hot Spots Policing

A hot spots policing approach is recommended for Precinct 73's southern sector, especially along Dumont Avenue, Chester Street, Livonia Avenue, and Mother Gaston

Boulevard. Increasing patrols and maintaining a high-visibility police presence in areas surrounding low-income apartment complexes, like Marcus Garvey Village on Chester Street and the Van Dyke Houses on Livonia Avenue, are recommended.

Furthermore, it is strongly suggested that this strategy be implemented from June through August, as well as major holidays (e.g., Memorial Day, July 4<sup>th</sup>, Thanksgiving, Christmas, and New Year's Eve). During the summer months, an increased police presence is recommended for Tuesdays, Wednesdays, and weekends, between the hours of 8 AM – 3 PM and 9 PM – 2 AM. If possible, an increased presence is also recommended in these areas from October through December, throughout the week and especially overnight, between the hours of 5 PM to 6 AM.

Studies have shown that effective high visibility tactics include the use of marked police cars and having car patrols sit stationary in hot spots for approximately 15 minutes during peak crime periods (Ratcliffe et al., 2020; Smith et al., 2024). According to Ratcliffe et al. (2020), maintaining a visible police presence when targeting hot spots is critical for producing a statistically significant deterrent effect. However, as Novak et al. (2016) have noted, these tactics may only result in temporary reductions of violent crime. In an evaluation of increased foot patrols in hot spots, the authors found that violent crime rates decreased before returning to pre-intervention levels after a month. It should be noted that other studies have found foot patrols to have little to no crime deterrent effect, though this approach has been associated with reductions in residents' fear of crime (Bowers & Hirsch, 1987; Police Foundation, 1981; Weisburd & Eck, 2004). Either way, tactical responses should be complemented with long-term deterrent strategies, especially those that involve problem-solving techniques and partnerships with community stakeholders.

## Strategic Response: Problem-Oriented Policing & Focused Deterrence

As for long-term violence prevention strategies, the development of a focused deterrence initiative (FDI) is recommended. This approach aims to discourage offending behaviors by making high-risk individuals aware of heightened punitive consequences, while offering incentives and pathways to lead healthier, non-criminal lives. Braga et al. (2018) have found this strategy to be especially effective for producing moderate reductions in gang-involved gun violence. However, program evaluations in recent years have pointed out that deterrent effects of FDIs seem to deteriorate after a few years, despite fidelity to program implementation (Fox & Novak, 2018; Grunwald & Papachristos, 2017).

As such, the consistent application of problem-oriented policing techniques – namely, the SARA model – will be critical when pursuing continued success of long-term programs, like focused deterrence initiatives. Using the SARA model is important for accurately identifying high-risk populations, analyzing the problem at hand, targeting the intervention to its intended audience, and evaluating the impact of the intervention.

Furthermore, not only do focused deterrence initiatives provide an opportunity to reduce crime through a targeted approach, but they also enable partnerships between police, community members, and other stakeholders that could increase mutual trust and promote strong policecommunity relations. A report by RAND (n.d.) also cited community support as a key factor in deterring offending behaviors when police are no longer present. Thus, fostering community partnerships may be a potential solution to deteriorating program effects associated with focused deterrence initiatives.

In addition to deterring high-risk populations through the traditional FDI approach, it is recommended that law enforcement develop partnerships with schools, mentoring programs, and other after-school programs for the purpose of early deterrence. Based on victim demographics data in 2023, individuals younger than 18 years old made up 12% victims in Precinct 73. This was a relatively small percentage compared to those aged between 18 and 44. Positive policecommunity relations may prevent youth from engaging in risky behaviors and from becoming part of the high-risk population later on. Using the SARA model to continually assess the impact of community support on post-intervention crime levels could be one way in which long-term violence prevention strategies can be refined and sustained.

### **Study Limitations & Suggestions for Future Research**

### Missing Geographic Values for Mapping Purposes

Of the 990 NFS incidents in the 2023 dataset, 44 of them lacked latitude-longitude data. In other words, 4% of all NFS incidents in the dataset could not be mapped. Although this impacted the choropleth maps in Figures 1 and 4, which were based on incident counts, the hottest precincts for NFS incidents were determined using calculated crime rates and tabular data analysis. All incidents were included in this stage of analysis because the Precinct variable provided the necessary geographic information, thus precluding the need for latitude-longitude coordinates. Therefore, all results based on calculated NFS rates were accurate.

When mapping all 2023 NFS incidents in Precinct 73, only one out of 42 incidents lacked latitude-longitude coordinates. Although this affected the final mapped results, the impact was negligible because one incident accounted for only 2% of all cases.

### Missing Victim-Offender Demographics Data

The dataset used for this project contained mostly null values for the following variables: location description, perpetrator age group, perpetrator sex, and perpetrator race. Since data in these fields were incomplete, analyses could not be performed on hotspot location type (e.g., public housing, bar/night club) nor on high-risk perpetrator demographics without sacrificing the validity of findings. An analysis of perpetrator demographics would have been especially useful to help law enforcement understand which populations in Brooklyn and the Bronx are most atrisk for engaging in gun violence and, thus, which groups to target for violence prevention and reduction programs.

As discussed, the analysis of victim demographics in this project was limited due to the original dataset's partial documentation of victim data. When analyzing NFS incidents in 2023 for Precinct 73, victim demographics were provided for only 42 out of 79 total incidents. Therefore, readers should bear in mind that findings on gender and age demographics of victims were only based on approximately 53% of incidents.

Incomplete demographics data may have resulted in part from difficulties associated with identifying individuals involved in active investigations. Since future research on New York City gun violence would benefit greatly from analyses of at-risk populations, professionals and scholars may need to consider other avenues for the collection of victim-offender demographics data. It may be possible to cull offender demographics using data on incarcerated shooters from state prisons or databases like the National Prisoner Statistics. However, this also presents a data validity issue because incarcerated individuals make up only a portion of all shooters. Nonetheless, it is strongly recommended that future researchers find new ways to track and collect demographics data on victims and offenders because placing these insights within the context of spatiotemporal analyses could help explain seasonal shooting patterns and, ultimately, inform effective intervention strategies.

Furthermore, if reliable data on victim-offender demographics can be obtained, analyses that aim to predict high-risk populations may benefit from the integration of social network analysis techniques. In particular, Green et al. (2017) recommended analyzing demographics data through the lens of a social contagion model to strengthen the accuracy of predictions that identified high-risk subjects of gun violence. The authors found that this hybrid model correctly identified 53% - 72% more subjects than models that were based solely on demographics data.

Such improvements are important for refining crime analysis techniques that aim to study gun violence and for identifying high-risk offenders in a given area. These considerations not only affect the validity of violent crime assessments, but they also affect how law enforcement personnel choose to address gun violence in hot spots and how successful those responses will be. As several authors have noted, accurate assessments of high-risk populations are critical for the planning and development of effective place-based gun violence interventions, like focused deterrence initiatives (RAND, n.d.; Scott, 2017; Rossi et al., 2019).

### **VII.** Conclusion

All in all, analyses on non-fatal shootings in New York City over the past ten years identified Precinct 73 in Brooklyn as having the highest NFS shooting rates, followed by multiple precincts in the Bronx. In Precinct 73, shooting incidents were clustered in one general area in a socioeconomically disadvantaged neighborhood. Additionally, repeat incidents were located within a few blocks of each other and occurred at or near low-income housing complexes or public spaces, like transportation stops and parking lots. There has generally been a spike in NFS incidents during the summer months, but the annual number of non-fatal shootings has been within the normal range for Precinct 73 for the past three years. Overall, spatiotemporal analyses like these and crime analysis as a field are essential for identifying patterns of activity from vast amounts of data. Insights derived from such analyses ultimately serve to help law enforcement understand problems within their community and how they can be solved in the most strategic and effective ways possible.

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