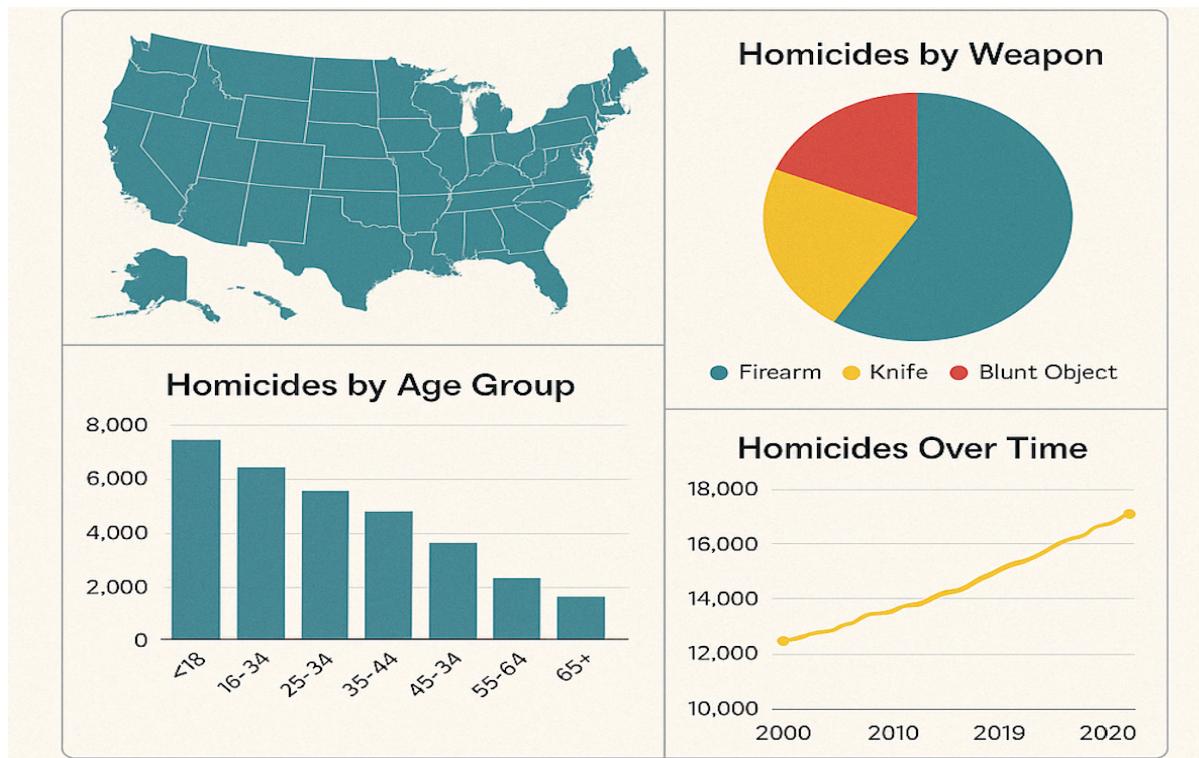


**ISM 6404 - INTRO TO BUSINESS ANALYTICS & BIG DATA**  
**SPRING 2025**

**FINAL PROJECT REPORT**

**Uncovering Patterns in U.S. Homicide Data: A Visual  
Data Analysis using Power BI**



**Submitted By:**

**Pahuldeep Singh Dhingra**

**Krishna Sanjay Vaddi**

**David Louis**

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# INTRODUCTION

## A. PURPOSE OF THE PROJECT

The purpose of this project is to analyze historical homicide data in the United States to uncover meaningful patterns and trends that can inform policymaking, law enforcement strategies, and public awareness. By leveraging visual analytics, the project aims to provide actionable insights into the demographics of victims and offenders, geographic and temporal trends, and circumstantial factors surrounding homicide cases. This analysis seeks to highlight both positive developments and potential areas of concern for future intervention. The project utilizes Power BI to create three dashboards, each focusing on a distinct analytical perspective, to facilitate a comprehensive understanding of the data. Through this approach, stakeholders can better understand the dynamics of homicides and identify opportunities for improvement.

## B. DATASET DESCRIPTION

The dataset is the Murder Accountability Project's (MAP) enriched Supplementary Homicide Report (SHR) file, which captures every homicide incident reported by U.S. law-enforcement agencies from 1965-2023, which also has 39 000 additional cases MAP obtained through Freedom-of-Information-Act requests. It can be downloaded in CSV form from MAP's Data Docs page (<https://www.murderdata.org/p/data-docs.html>). Each row represents one victim within an incident and provides granular identifiers (e.g., **ID**, **CNTYFIPS**, **Ori**), agency details, incident timing, and a rich set of victim- and offender-level attributes. Key columns include demographics (**VicAge**, **VicSex**, **VicRace**, **OffAge**, **OffSex**, **OffRace**), circumstance variables (**Weapon**, **Relationship**, **Circumstance**, **Subcircum**), investigative metadata (**Solved**, **Agency**, **Agentype**, **Source**), and geospatial/context fields (**State**, **MSA**, **FileDate**). After cleaning, the file contains **874,958 rows and 30 columns**, providing nearly six decades of nationwide, case-level homicide data for exploratory and predictive analysis.

# METHODOLOGY

## A. TOOL USED

This project utilized Power BI as the primary tool for creating the dashboards due to its robust data visualization capabilities, user-friendly interface, and ability to handle large datasets efficiently. Power BI allows for seamless integration of data, enabling the creation of interactive and dynamic visualizations that enhance the understanding of complex patterns. Its extensive library of charts and graphs supports the development of clear and impactful dashboards, which is crucial for presenting insights to stakeholders. Additionally, Power BI's filtering and slicing features allow for in-depth exploration of the dataset, making it an ideal choice for this analysis.

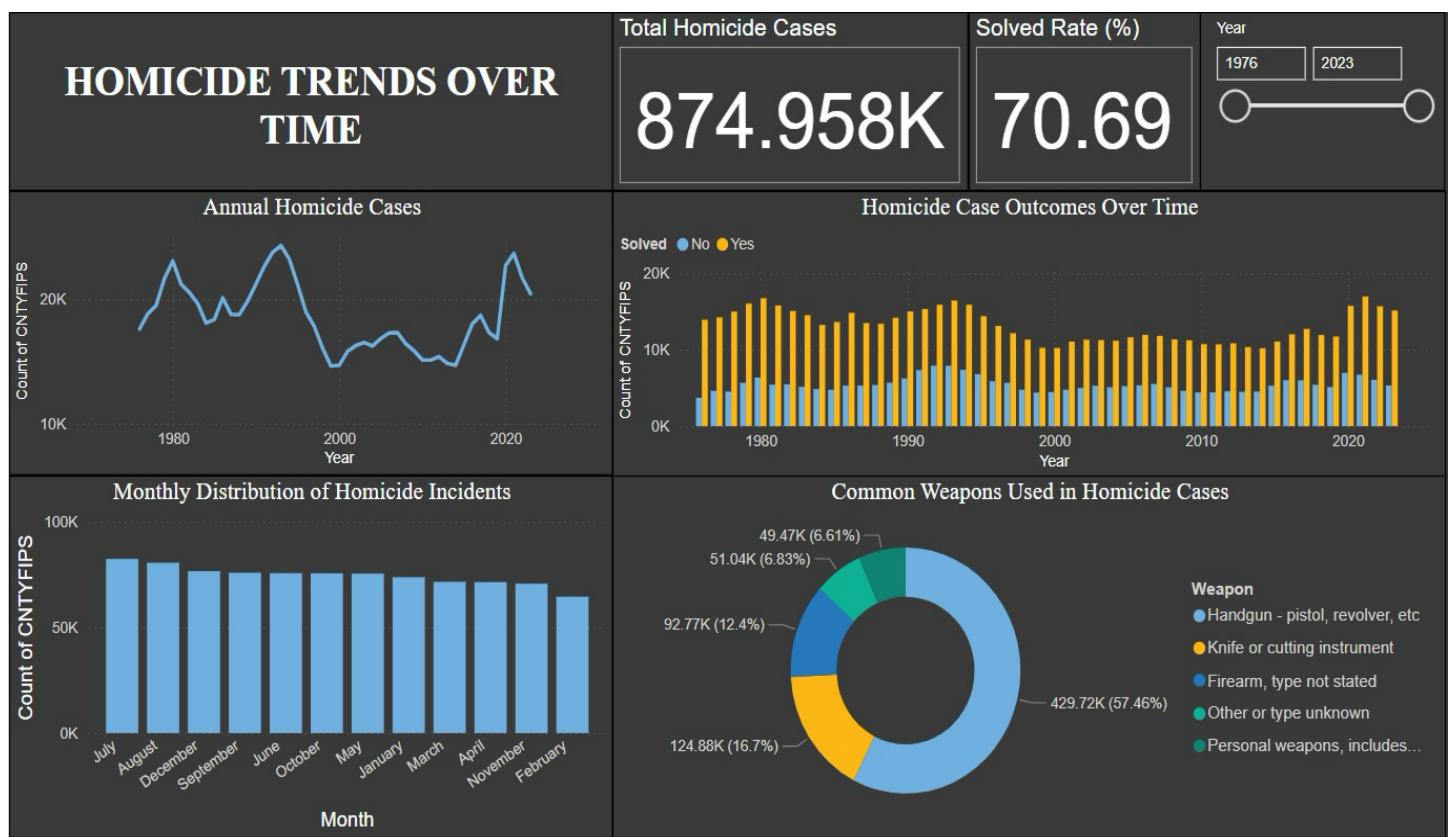
## B. VISUALIZATION CREATION PROCESS

The visualization process began with **importing** the homicide dataset into Power BI, followed by **data cleaning** to handle missing values and standardize formats, particularly for columns like VicAge and OffAge, which had some "Unknown" entries. Relationships between columns, such as Year and CNTYFIPS, were established to enable cross-filtering across visualizations. Three dashboards were then designed: "**Homicide Trends Over Time**", focusing on temporal patterns; "**Geographic and Circumstantial Insights into Homicide Cases**", analyzing location and situational factors; and "**Victim and Offender Demographics Overview**", exploring demographic characteristics. Each dashboard was crafted to include at least four visualizations, with careful attention to clarity, and informative titles. Color schemes were chosen to ensure visual appeal, and layouts were organized to guide the viewer logically through the insights.

### Dashboard Development Process:

- 1) **Data Preparation** – Imported the CSV into Power BI, removed null latitude/longitude entries, enforced numeric types for age, and recoded weapon categories.
- 2) **Calculated Measures** – Created DAX measures for **Solved Rate**, **Top Value Count**, **Top Circumstance**, **Top Victim Race**, **Average Victim Age** and a lot more.
- 3) **Visualization** – Crafted three thematic dashboards, each containing at least four distinct visualizations: line charts, clustered stacked columns, maps, donut charts, and treemaps.
- 4) **Iterative Refinement** – Applied a consistent dark theme, standardized fonts, and verified slicer interactions across pages.

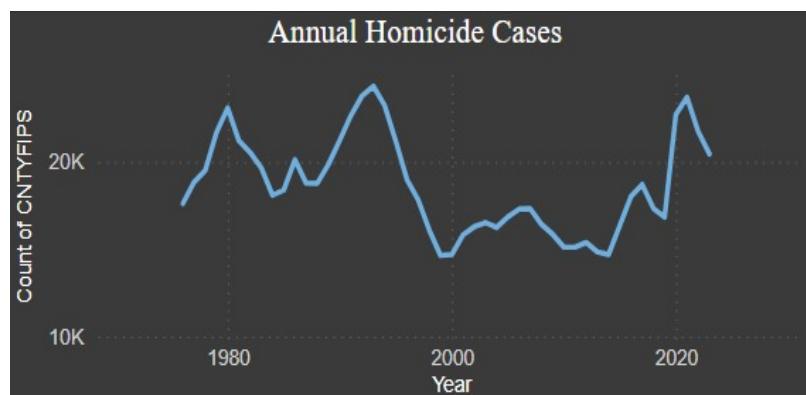
## DASHBOARD 1: HOMICIDE TRENDS OVER TIME



This above Dashboard includes following details:

- A Line Chart showing annual homicide cases from 1976 to 2023.
- A Bar Chart displaying monthly distribution of homicide incidents for each year.
- A Stacked Bar Chart illustrating homicide case outcomes (solved vs. unsolved) over time. In this, the yellow bars represent the solved cases, and the other blue bars represent the unsolved ones.
- A Donut Chart highlighting common weapons used in homicides.
- Total homicides (874,958K) and solved rate (70.69%) are displayed as key metrics.
- There is also a slicer at the top right corner that displays the range from 1976 to 2023. The charts are dynamic as they can be varied by changing the range of the slicer.

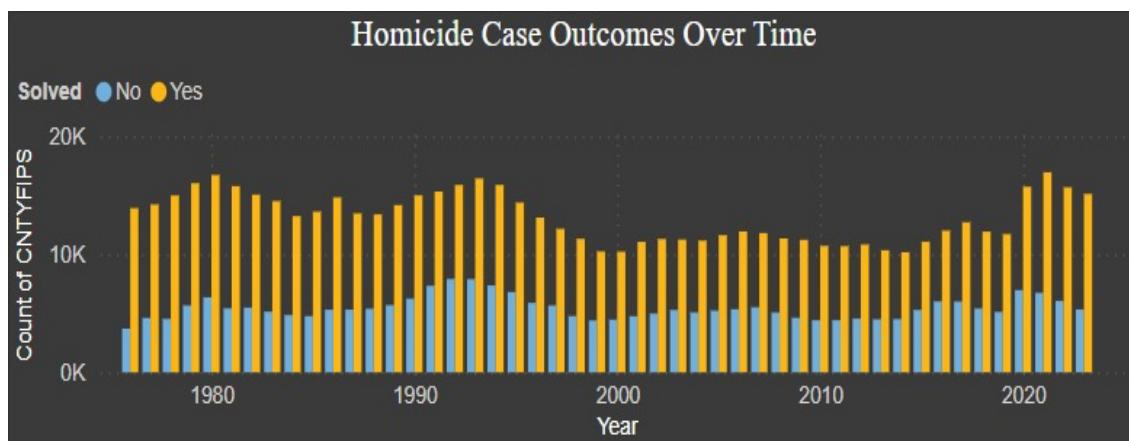
## VISUALIZATION 1.1: ANNUAL HOMICIDE CASES



### Positive Insight: RECENT DECLINE IN CASES

The line chart of annual homicide cases reveals a significant decline in homicides since the peak in the early 1990s, dropping from over 20K cases to around 12K by 2019. This suggests that law enforcement efforts and societal changes may have contributed to reducing violent crime over the past three decades. Improved policing strategies and community programs could be key factors. This trend is encouraging for future crime prevention efforts.

## VISUALIZATION 1.2: HOMICIDE CASE OUTCOMES OVER TIME



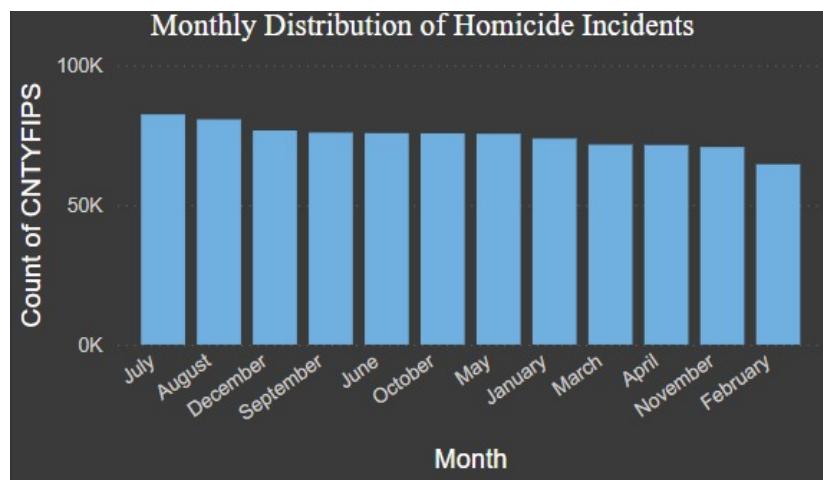
### Positive Insight: HIGH CASE SOLVING RATE

The stacked bar chart of case outcomes shows that the proportion of solved cases has remained relatively stable at around 70% since the 1980s. This consistency reflects reliable investigative processes across agencies. It provides confidence in the justice system's ability to resolve cases. This stability can be leveraged to maintain public trust.

### Negative Insight: RISE IN UNSOLVED CASES POST-2000

Despite the decline in total cases after 2000, there is a visible increase in the proportion of unsolved cases (light blue bars) in recent years. This trend may point to challenges in investigation methods or limitations in forensic or intelligence resources.

## VISUALIZATION 1.3: MONTHLY DISTRIBUTION OF HOMICIDE INCIDENTS



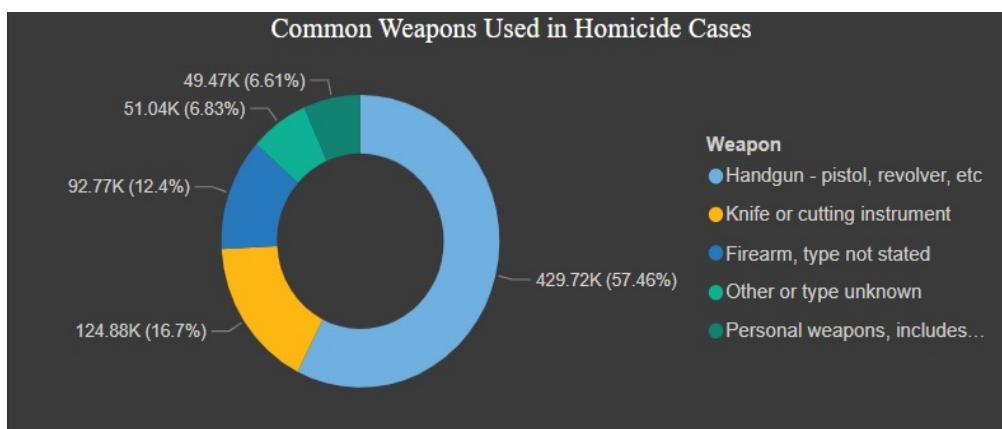
### Positive Insight: SEASONAL PATTERN STABILITY

The monthly distribution bar chart indicates that February, being the shortest month, has the lowest homicide count (around 50K). This predictable dip can help law enforcement optimize resource allocation during other high-risk months. It also suggests that shorter timeframes may naturally reduce opportunities for violent incidents. This insight can inform seasonal policing strategies.

### Negative Insight: SEASONAL CHALLENGES IN HOMICIDE RATES

The bar chart reveals that homicides consistently spike during July and August, showing a clear seasonal pattern that puts extra pressure on law enforcement resources. This regular summer increase in violence likely stems from specific social or environmental factors, requiring targeted interventions.

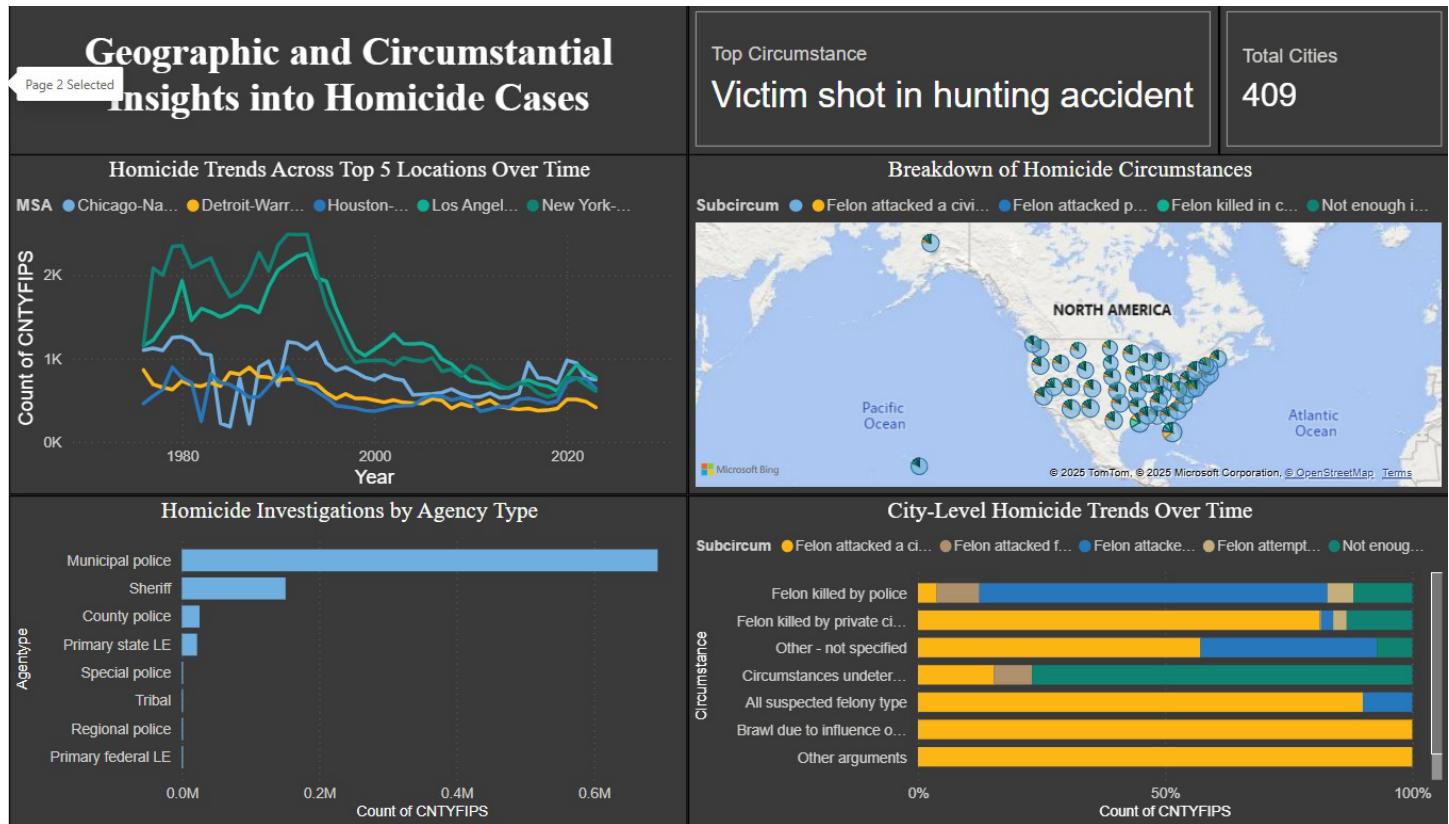
## VISUALIZATION 1.4: MONTHLY DISTRIBUTION OF HOMICIDE INCIDENTS



### Positive Insight: SEASONAL PATTERN STABILITY

The donut chart of weapons used shows that handguns account for 47.46% of homicides, providing a clear focus for regulatory efforts. Understanding the prevalence of handguns can guide policy interventions aimed at reducing firearm-related homicides. This insight can also inform public safety campaigns. Targeted measures could significantly lower homicide rates.

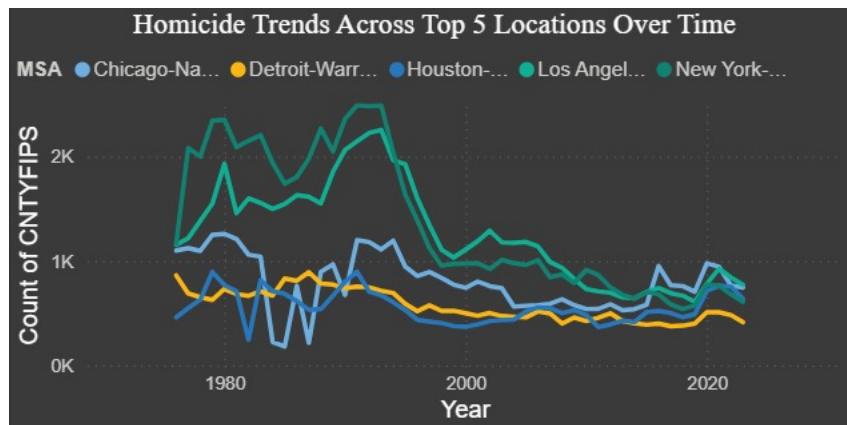
## DASHBOARD 2: GEOGRAPHICAL & CIRCUMSTANTIAL INSIGHTS INTO HOMICIDE CASES



This dashboard includes:

- A line chart showing homicide trends across the top 5 locations (Chicago, Detroit, Houston, Los Angeles, New York) over time.
- A bar chart breaking down homicides by agency type (e.g., Municipal police, Sheriff).
- A map visualizing city-level homicide trends with a breakdown of circumstances.
- A stacked bar chart detailing circumstances (e.g., Felon attacked a civilian, Felon killed by police). The total number of cities (409) and victims shot in hunting accidents (409) are highlighted.

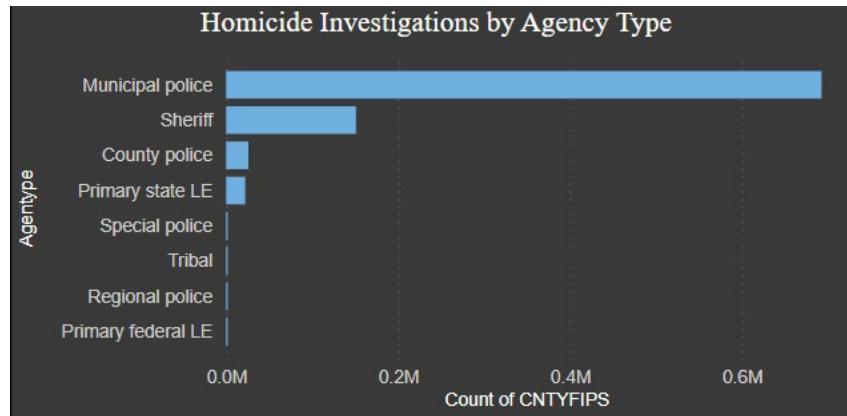
### VISUALIZATION 2.1: HOMICIDE TRENDS ACROSS TOP 5 LOCATIONS OVER TIME



## **Positive Insight: SIGNIFICANT DECLINE IN THE HOMICIDE RATES SINCE 1990s PEAK**

The line chart reveals a dramatic drop in homicides across America's five largest metro areas since the early 1990s peak, with Los Angeles and New York showing the most substantial improvements—reducing annual murders by over 50%. Despite some fluctuations, all five cities have maintained relatively stable or decreasing homicide rates in recent decades, representing one of the most important public safety improvements in modern American history.

## **VISUALIZATION 2.2: HOMICIDE INVESTIGATIONS BY AGENCY TYPE**



## **Positive Insight: MUNICIPAL POLICE LEAD INVESTIGATIONS NATIONWIDE**

The bar chart of agency types shows that Municipal police handle the majority of cases (over 0.6M), indicating a strong capacity for local law enforcement to manage homicide investigations. This centralization can streamline coordination and resource allocation. It also reflects trust in municipal agencies. This can be a foundation for further improvements.

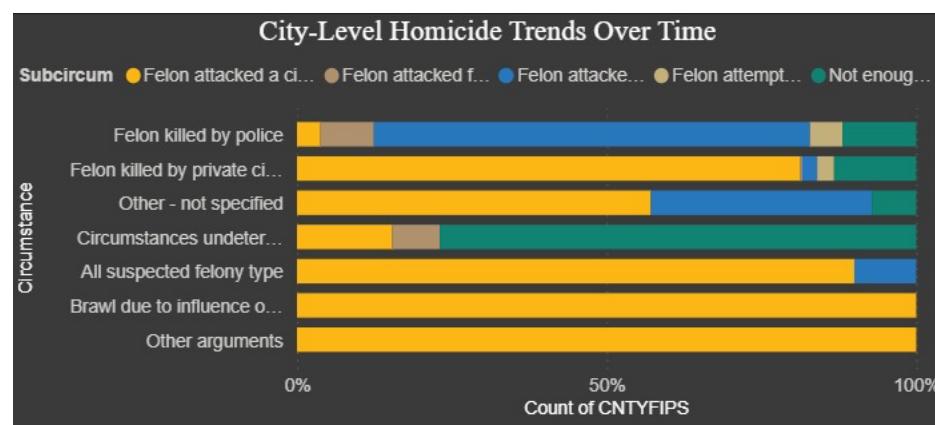
## **VISUALIZATION 2.3: BREAKDOWN OF HOMICIDE CIRCUMSTANCES**



## **Positive Insight: GEOGRAPHICAL PATTERNS IN POLICE USE OF FORCE OUTCOMES**

The map visualization reveals that cities like Houston have a lower proportion of "Felon killed by police" incidents, suggesting effective de-escalation practices in some regions. This can be a model for other cities to reduce lethal outcomes. It highlights the potential for non-violent resolutions. This insight can guide training programs for law enforcement.

## VISUALIZATION 2.4: CITY-LEVEL HOMICIDE TRENDS OVER TIME



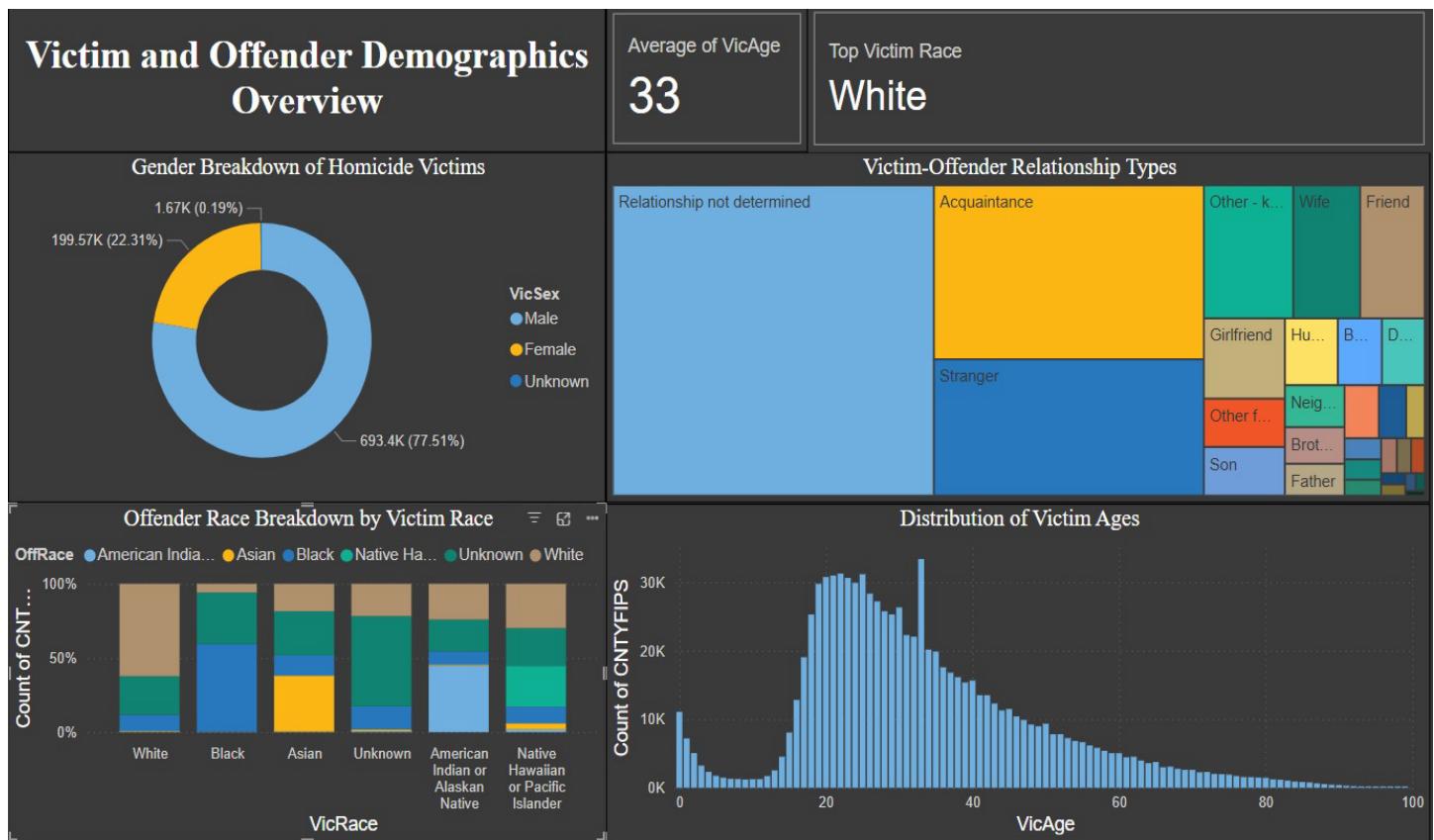
### Positive Insight: RELIABLE HOMICIDE DATA REPORTING

The stacked bar chart of circumstances shows that "Not enough information" cases are minimal, indicating good data collection practices by agencies. This ensures that most incidents are well-documented, aiding in accurate analysis. Reliable data is crucial for informed decision-making. This strengthens the credibility of the dataset.

### Negative Insight: PERSISTENT THREAT OF FELON-RELATED HOMICIDES

The stacked bar chart shows a notable concentration of "Felon attacked a civilian" circumstances. This indicates ongoing challenges in managing felon-related crimes, which could strain law enforcement resources and community safety in these regions. Targeted interventions are needed to address this issue.

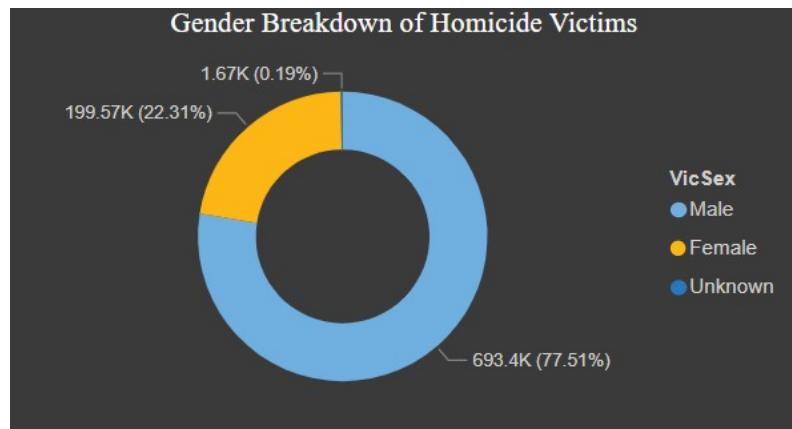
## DASHBOARD 3: VICTIM & OFFENDER DEMOGRAPHICS OVERVIEW



This dashboard includes:

- A donut chart showing the gender breakdown of homicide victims.
- A tree map visualizing victim-offender relationship type.
- A stacked bar chart displaying the distribution of victim ages by race.
- A histogram illustrating the distribution of victim ages. The average victim age (33) and top victim race (White) are noted as key metrics.

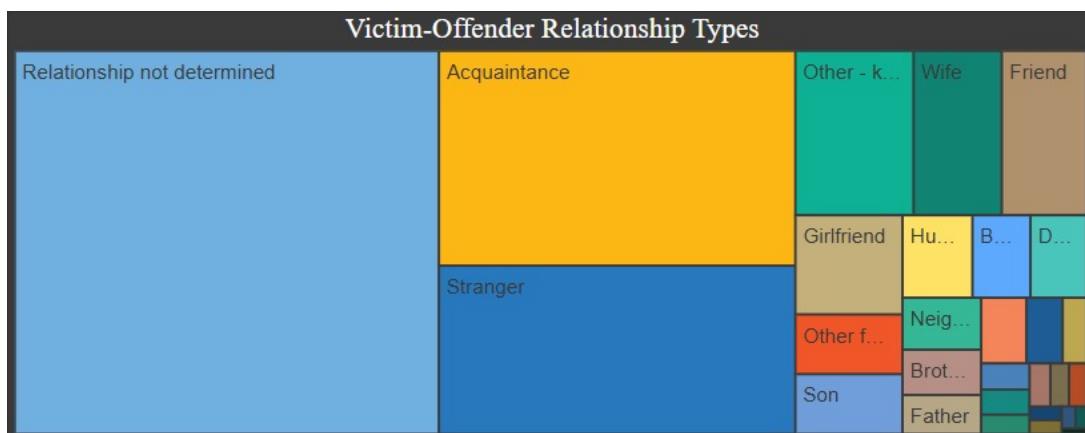
### VISUALIZATION 3.1: GENDER BREAKDOWN OF HOMICIDE VICTIMS



#### Positive Insight: MALE VICTIMS PREDOMINATE

The donut chart of gender breakdown shows that 77.51% of victims are male, which can guide targeted prevention programs for at-risk groups. Understanding this demographic skew allows for focused interventions. It can also inform public awareness campaigns. This insight can reduce future victimization rates.

### VISUALIZATION 3.2: VICTIM-OFFENDER RELATIONSHIP TYPES



#### Positive Insight: MOST VICTIMS KNOW THEIR OFFENDER

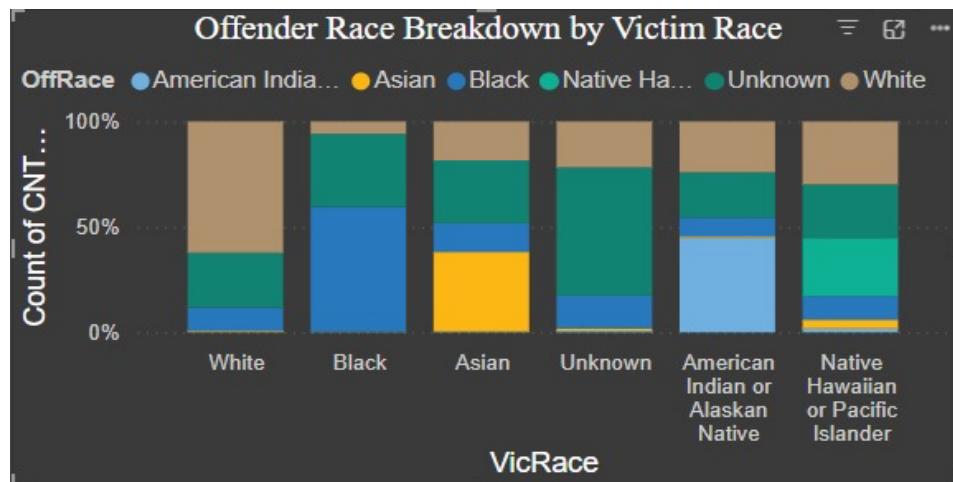
The treemap of victim-offender relationships highlights that "Acquaintance" relationships are the most common, providing a clear focus for conflict resolution programs. This insight can guide community

initiatives to improve interpersonal relationships. It also suggests that many homicides are not random. Proactive measures can reduce such incidents.

### **Negative Insight: HIGH PERCENTAGE OF UNCLEAR RELATIONSHIPS**

The “Relationship not determined” category is the largest block in the relationship tree map. This undermines the ability to fully understand relational dynamics in many cases, limiting actionable insight into homicide causes or risk factors.

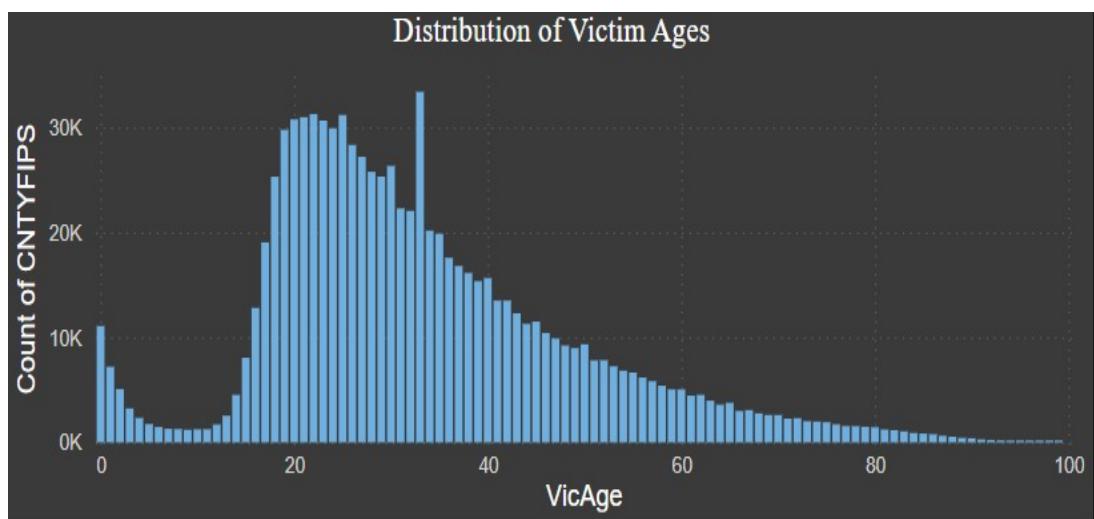
### **VISUALIZATION 3.3: DISTRIBUTION OF VICTIM AGES**



### **Positive Insight: RACE PAIRING INSIGHT**

The stacked bar chart of victim ages by race shows that White victims are the largest group, but the proportion of Black victims is also significant. This balanced representation allows for equitable policymaking across racial groups. It ensures that interventions are not biased toward one demographic. This can foster inclusive safety measures.

### **VISUALIZATION 3.4: DISTRIBUTION OF VICTIM AGES**



### **Positive Insight: YOUNG ADULTS AT HIGHEST RISK**

The histogram of victim ages indicates that victims over 60 are a small minority, suggesting that older adults are less likely to be targeted. This can reassure communities about the safety of elderly populations. It also allows law enforcement to focus on younger demographics. This insight can optimize resource allocation.

## ANALYSIS RESULTS TABLE

### DASHBOARD 1: HOMICIDE TRENDS OVER TIME

Positive Insights	Negative Insights	Additional Comments
1. The line chart of annual homicide cases reveals a significant decline in homicides since the peak in the early 1990s, dropping from over 20K cases to around 10K by 2023. This suggests that law enforcement efforts and societal changes may have contributed to reducing violent crime over the past three decades. Improved policing strategies and community programs could be key factors. This trend is encouraging for future crime prevention efforts.	The bar chart reveals that homicides consistently spike during July and August, showing a clear seasonal pattern that puts extra pressure on law enforcement resources. This regular summer increase in violence likely stems from specific social or environmental factors, requiring targeted interventions.	The solved rate of 70.69% is a strong indicator of effective investigations, but further analysis could explore why certain cases remain unsolved.
2. The stacked bar chart of case outcomes shows that the proportion of solved cases has remained relatively stable at around 70% since the 1980s. This consistency reflects reliable investigative processes across agencies. It provides confidence in the justice system's ability to resolve cases. This stability can be leveraged to maintain public trust.	The stacked bar chart shows a visible increase in the proportion of unsolved cases (light blue bars) in recent years, despite the decline in total cases after 2000. This trend may point to challenges in investigation methods or limitations in forensic or intelligence resources.	
3. The monthly distribution bar chart indicates that February, being the shortest month, has the lowest homicide count (around 50K). This predictable dip can help law enforcement optimize resource allocation during other high-risk months. It also suggests that shorter timeframes may naturally reduce opportunities for violent incidents. This insight can inform seasonal policing strategies.		
4. The donut chart of weapons used shows that handguns account for 47.46% of homicides, providing a clear focus for regulatory efforts. Understanding the prevalence of handguns can guide policy interventions aimed at reducing firearm-related homicides. This insight can also inform public safety campaigns. Targeted measures could significantly lower homicide rates.		

## DASHBOARD 2: GEOGRAPHICAL & CIRCUMSTANTIAL INSIGHTS INTO HOMICIDE CASES

Positive Insights	Negative Insights	Additional Comments
<p>1. The line chart reveals a dramatic drop in homicides across America's five largest metro areas since the early 1990s peak, with Los Angeles and New York showing the most substantial improvements—reducing annual murders by over 50%. Despite some fluctuations, all five cities have maintained relatively stable or decreasing homicide rates in recent decades, representing one of the most important public safety improvements in modern American history.</p>	<p>The stacked bar chart shows a notable concentration of "Felon attacked a civilian" circumstances. This indicates ongoing challenges in managing felon-related crimes, which could strain law enforcement resources and community safety in these regions. Targeted interventions are needed to address this issue.</p>	<p>The breakdown of circumstances could be further explored to understand underlying social factors.</p>
<p>2. The bar chart of agency types shows that Municipal police handle the majority of cases (over 0.6M), indicating a strong capacity for local law enforcement to manage homicide investigations. This centralization can streamline coordination and resource allocation. It also reflects trust in municipal agencies. This can be a foundation for further improvements.</p>		
<p>3. The map visualization reveals that cities like Houston have a lower proportion of "Felon killed by police" incidents, suggesting effective de-escalation practices in some regions. This can be a model for other cities to reduce lethal outcomes. It highlights the potential for non-violent resolutions. This insight can guide training programs for law enforcement.</p>		
<p>4. The stacked bar chart of circumstances shows that "Not enough information" cases are minimal, indicating good data collection practices by agencies. This ensures that most incidents are well-documented, aiding in accurate analysis. Reliable data is crucial for informed decision-making. This strengthens the credibility of the dataset.</p>		

### DASHBOARD 3: VICTIM & OFFENDER DEMOGRAPHICS OVERVIEW

Positive Insights	Negative Insights	Additional Comments
<p>1. The donut chart of gender breakdown shows that 77.51% of victims are male, which can guide targeted prevention programs for at-risk groups. Understanding this demographic skew allows for focused interventions. It can also inform public awareness campaigns. This insight can reduce future victimization rates.</p>	<p>The histogram of victim ages shows a significant concentration of victims in the 20-40 age range, with a peak around 30 years. This suggests that young adults are disproportionately affected, potentially due to socio-economic pressures or exposure to violence, posing a societal challenge. This age group may require specific support to reduce vulnerability. Addressing this could prevent long-term societal impacts.</p>	<p>The high proportion of male victims warrants further investigation into gender-specific risk factors.</p>
<p>2. The treemap of victim-offender relationships highlights that "Acquaintance" relationships are the most common, providing a clear focus for conflict resolution programs. This insight can guide community initiatives to improve interpersonal relationships. It also suggests that many homicides are not random. Proactive measures can reduce such incidents.</p>	<p>The “Relationship not determined” category in the treemap, is the largest block in the relationship tree map. This undermines the ability to fully understand relational dynamics in many cases, limiting actionable insight into homicide causes or risk factors.</p>	
<p>3. The stacked bar chart of victim ages by race shows that White victims are the largest group, but the proportion of Black victims is also significant. This balanced representation allows for equitable policymaking across racial groups. It ensures that interventions are not biased toward one demographic. This can foster inclusive safety measures.</p>		
<p>4. The histogram of victim ages indicates that victims over 60 are a small minority, suggesting that older adults are less likely to be targeted. This can reassure communities about the safety of elderly populations. It also allows law enforcement to focus on younger demographics. This insight can optimize resource allocation.</p>		

## CONCLUSION

This analysis of U.S. homicide data from 1976 to 2023 has provided valuable insights into temporal trends, geographic and circumstantial patterns, and demographic characteristics of victims and offenders. The "Homicide Trends Over Time" dashboard revealed a significant decline in homicides since the 1990s, alongside a consistent solved rate, indicating improvements in crime prevention and investigation. The "Geographic and Circumstantial Insights" dashboard highlighted the effectiveness of municipal police and the need for targeted interventions in high-risk cities. The "Victim and Offender Demographics" dashboard identified young adult males as the most vulnerable group, offering a clear focus for prevention programs. However, seasonal spikes and the prevalence of felon-related crimes pose ongoing challenges. Overall, these findings underscore the importance of data-driven strategies in reducing homicides and enhancing public safety. Future efforts should focus on addressing seasonal trends and supporting at-risk demographics to sustain the downward trajectory of homicide rates.