ISM6419.901S24 - Data Visualization

by

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FINAL PROJECT REPORT

On

United States Gun Violence Homicides Demographical Analysis

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Table of Contents

1. Introduction

The prevalence of gun violence and its impacts on American society has been a significant issue in recent years, with escalating concerns over public safety, health, and social stability. This report seeks to provide an in-depth analysis of gun violence homicides across various U.S. states, investigate trends over time, and examine factors related to age, race, and gun sales. Using heat maps, trend analyses, and demographic breakdowns, the insights presented here aim to effectively inform data-driven policies to address gun-related violence.

2. Research Questions

- **Which U.S. states experience the highest and lowest rates of gun violence homicides?**

  This question explores the geographical variation in gun violence homicides across the United States, identifying states with the most and least severe issues.

- **How has the rate of gun violence homicides changed over time?**

  This examines trends in gun violence homicides over several years, focusing on whether rates have increased or decreased and identifying key factors driving these changes.

- **What are the demographic patterns in gun violence homicides (age and race)?**

  This question analyzes the age and racial demographics of individuals involved in gun violence homicides, identifying vulnerable groups and any disparities.

- **Is there a correlation between gun sales and gun violence homicides?**

  This investigates whether increased gun sales are linked to higher homicide rates, exploring the potential relationship between firearm availability and violence.

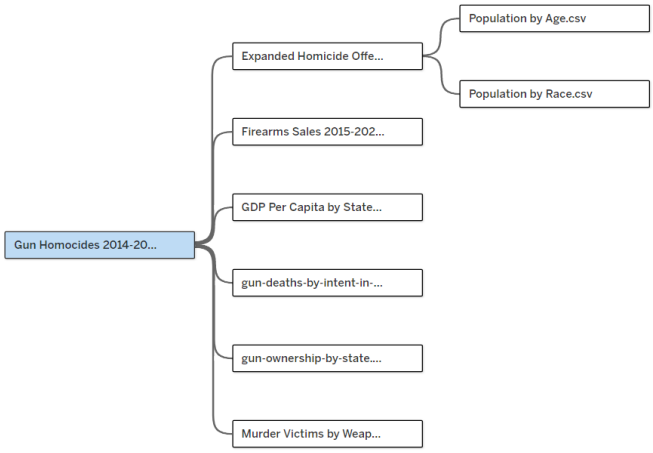
- **How do state-specific policies impact gun violence rates?**

  This examines the effectiveness of various state laws and regulations (e.g., background checks, and waiting periods) in reducing gun violence homicides, comparing states with stricter vs. more lenient laws.

3. Methodology

This study utilizes multiple datasets to analyze gun violence homicides across the United States, examining various dimensions such as demographics, gun ownership rates, and socioeconomic factors. Data from credible sources has been collected, cleaned, and processed to provide a thorough analysis. This section details the origin, content, and purpose of each dataset, followed by an outline of the data processing methods employed.

a. Data Source:



b. Datasets:

I. **FBI NICS Firearm Checks**

Description: This FBI dataset provides monthly and yearly firearm background check data by state and type. It serves as an indicator of gun sales and trends in firearm purchasing across states.

Source: **FBI NICS Firearm Checks**

II. **UCR Supplemental Homicide Report (SHR)**

Description: The SHR dataset, managed by the Uniform Crime Reporting (UCR) Program, includes detailed homicide data in the U.S., categorized by variables such as year, state, victim age group, race, and relationship to the offender. It provides critical information for analyzing patterns in gun-related homicides.

Source: **UCR Supplemental Homicide Report**

III. **Johns Hopkins Center for Gun Violence Solutions – Annual Firearm Violence Data**

Description: This dataset provides a comprehensive overview of U.S. gun violence trends, including data on firearm-related deaths by demographics (age, race), homicide rates, and comparisons across states. It allows for a demographic analysis of gun violence's impact and supports an understanding of the factors contributing to gun violence.

Source: **Johns Hopkins Center for Gun Violence Solutions**

IV. **Gun Ownership by State (2022)**

Description: This dataset from World Population Review provides gun ownership rates across U.S. states, illustrating the percentage of adults with firearms. The data includes state rankings, helping identify trends in gun ownership levels by region and allowing

comparisons with national averages. This resource can assist in analyzing state-by-state variations in gun culture and firearm prevalence.

Source: [World Population Review]

V. **U.S. GDP Per Capita by State**

Description: This dataset, sourced from Visual Capitalist, maps the Gross Domestic Product (GDP) per capita across U.S. states, illustrating economic productivity per person. It provides insights into regional economic disparities, highlighting the differences in wealth and productivity across the country's states.

Source: [Visual Capitalist]

VI. U.S. Census Bureau:

Description: The U.S. Census Bureau provides comprehensive population data, including total population counts, accessible via its official data portal. This data is frequently used for demographic analyses, policy planning, and research purposes, offering insight into population distributions, trends, and growth rates across the United States.

Source: [U.S. Census Bureau]

c. Data Cleaning and Processing:

- **Dataset Review**: Each dataset was first examined for its structure and content, ensuring that the data was consistent and complete for analysis.
- **Cleaning:** The data from each dataset was cleaned by removing duplicates, addressing missing values, and ensuring consistency across formats and data types.
- **Geographic Mapping:** The "State" field was converted to a geo-location variable in Tableau to enable geographic mapping. A heat map was created to visually represent state-specific gun

violence rates, measured as homicides per 100,000 people, highlighting regional trends in gun violence.

- **Data Normalization:** Demographic data was normalized to ensure accurate comparisons across variables such as age groups and race categories. Population size for each demographic group (by age and race) was used to calculate homicide rates per 100,000 for specific groups, allowing for a fair assessment of gun violence rates across different demographics.
- **Standardization Across Datasets**: All datasets involving demographic variables (Johns Hopkins Center for Gun Violence Solutions, UCR SHR, etc.) were standardized to the same demographic categories to ensure consistency across analyses.
- **Temporal and Demographic Analysis:** The processed data was structured to enable the creation of visualizations over time, by demographic groups (age, race), and by gun sales trends. This allowed for a more nuanced understanding of various factors influencing gun violence.

d. Data Visualization Tool:

For this individual project, Tableau was chosen as the main tool for creating data visualizations because it's easy to use and helps build interactive and visually appealing dashboards. Tableau's features make it simple to explore data insights and support decision-making. It offers a wide range of tools to customize charts and make the visuals more meaningful for the audience. I plan to use heat maps, pie charts, scatter plots, and line charts to show data trends, patterns, and relationships clearly, ensuring that the results are easy to understand.

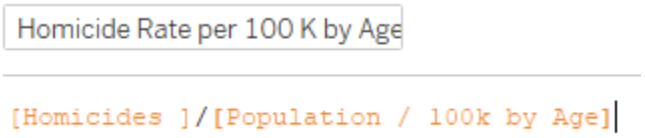
e. Calculations & Parameter

- **Population per 100k by Age**

  This calculation normalizes the population data by age group to a standard unit of 100,000 individuals. It aggregates the total population for each age group and divides it by 100,000, enabling consistent comparisons across different age groups.

- **Homicide Rate per 100k by Age**

  This metric represents the homicide rate per 100,000 individuals for each age group. It is calculated by dividing the total number of homicides by the normalized population (Population per 100k by Age), providing an age-specific rate. This helps identify which age groups are most affected by gun violence, allowing for focused interventions and policies.



- **Population per 100k by Race**

  Similar to the age-based normalization, this calculation adjusts the population data by race to a unit of 100,000 individuals. It aggregates the total population for each racial group and divides it by 100,000 to facilitate equitable cross-racial comparisons.

Population / 100k by Race

```
{ FIXED [Race] : SUM([Population (Population by Race.csv)])}/ 100000
```

- **Homicide Rate per 100k by Race**

  This measure calculates the homicide rate per 100,000 individuals for each racial group. It divides the total number of homicides by the normalized population (Population per 100k by Race), highlighting racial disparities in gun violence rates.

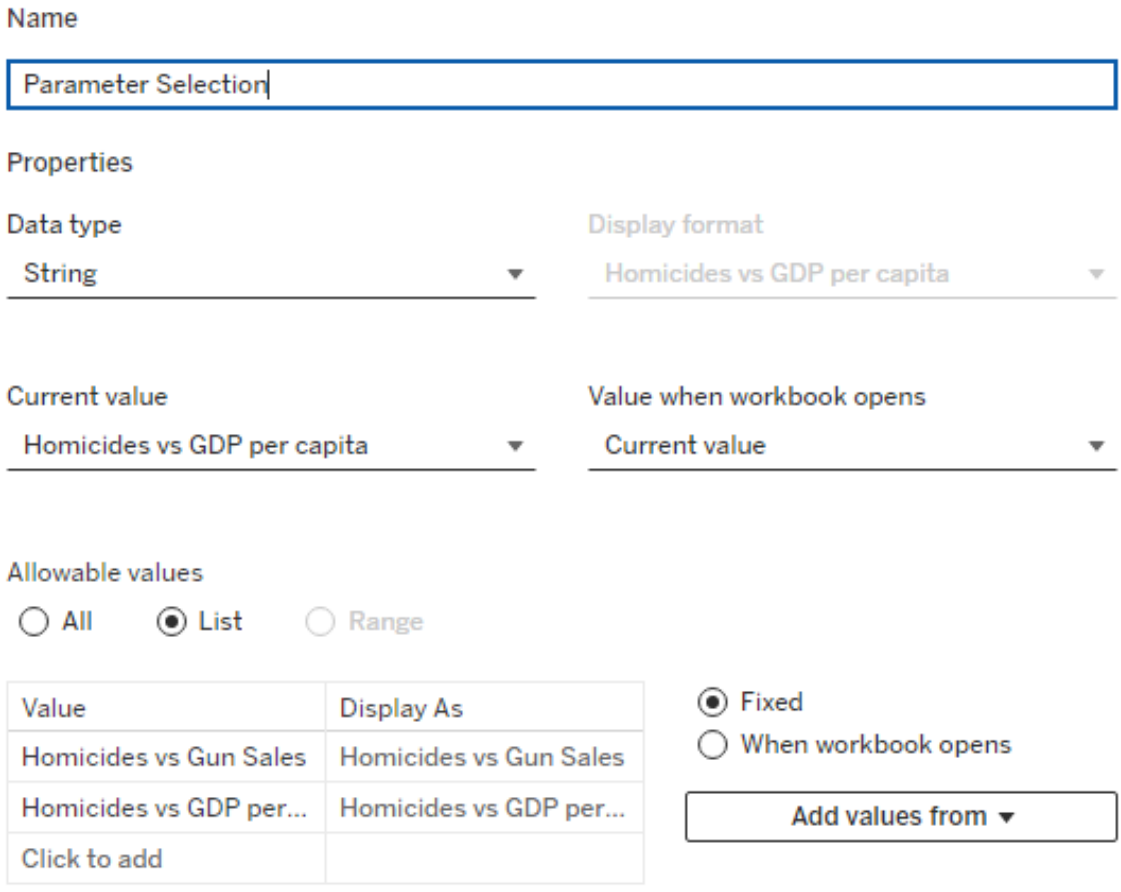
```
[Homicides ]/[Population / 100k by Race]
```

- **Parameter Calculation**

  This dynamic calculation allows for flexible analysis based on user selection. Depending on the chosen parameter ("Homicides vs Gun Sales" or "Homicides vs GDP per capita"), it returns

the corresponding value (Gun Sales or Income Per Capita) to support targeted comparisons and insights.

```
IF [Parameter Selection]="Homicides vs Gun Sales" THEN [Gun Sales]
ELSEIF [Parameter Selection]="Homicides vs GDP per capita" THEN [Income Per Capita]
END
```

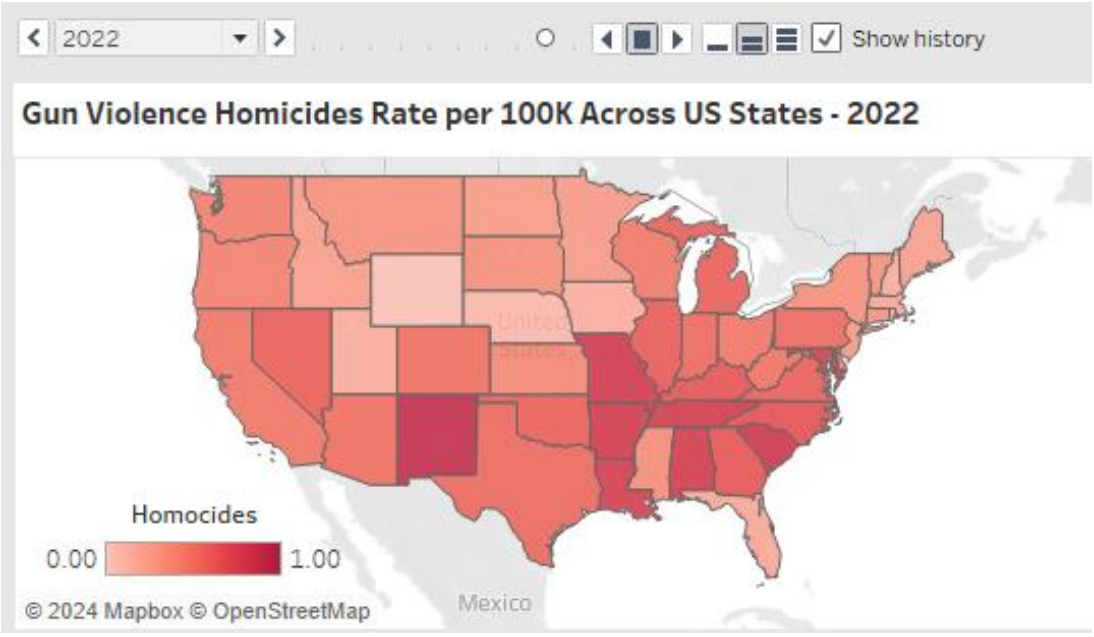


4. Visual Analysis

Gun violence remains a critical public health and safety issue in the United States, with significant variations in its impact across states and demographics. This analysis explores the geographic and temporal distribution of gun-related homicides, demographic patterns, and the potential correlations with gun ownership rates, gun sales, and economic factors. The data provides insight into the extent of the issue and informs potential strategies to address it.

1. Geographic Analysis of Gun Violence Homicide Rates in 2022

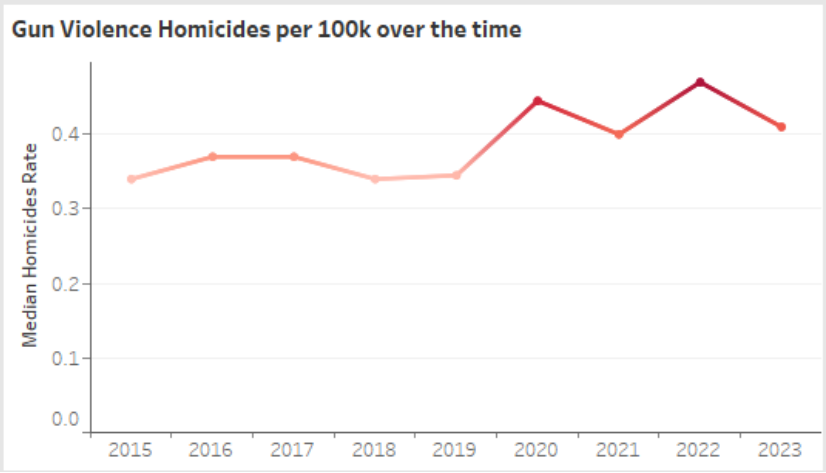
The heat map of gun violence homicides per 100,000 people in 2022 reveals substantial variation across U.S. states. Notably, the District of Columbia (D.C.) has the highest homicide rate, at 2.305 per 100,000, which is considerably above the national average. States like Alaska (0.885), New Mexico (0.9), and South Carolina (0.835) also exhibit high rates, indicating pockets of intense gun violence, particularly in the Southeast and some western states.



Conversely, states like Wyoming (0), Nebraska (0.075), and Rhode Island (0.135) report significantly lower rates of gun-related homicides, demonstrating a stark disparity across the country. This geographic variation may reflect differences in state-level regulations, cultural attitudes toward guns, and socioeconomic factors.

2. Trends in Gun Violence Homicides Over Time (2015-2023)

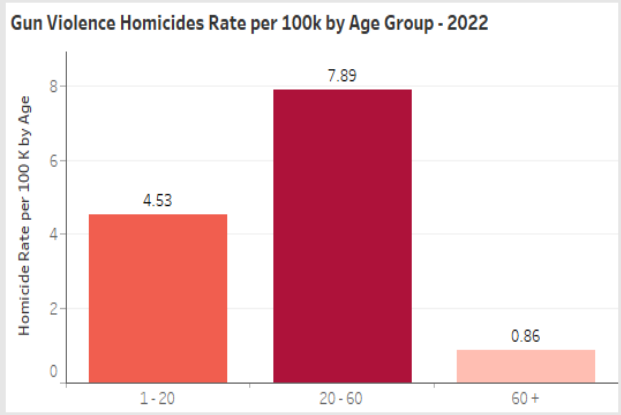
Analyzing gun violence homicide rates from 2015 to 2023 highlights a disturbing upward trend, especially since 2020. Between 2015 and 2019, the rate fluctuated slightly but remained relatively stable around 0.34-0.37 per 100,000. However, in 2020, the rate spiked to 0.445 and continued to increase, peaking at 0.47 in 2022 before slightly decreasing to 0.41 in 2023. The increase in gun violence homicides beginning in 2020 could correlate with the COVID-19 pandemic, which brought about economic strain, social isolation, and disruptions to law enforcement and public services. These challenging conditions may have contributed to increased violence in many communities.

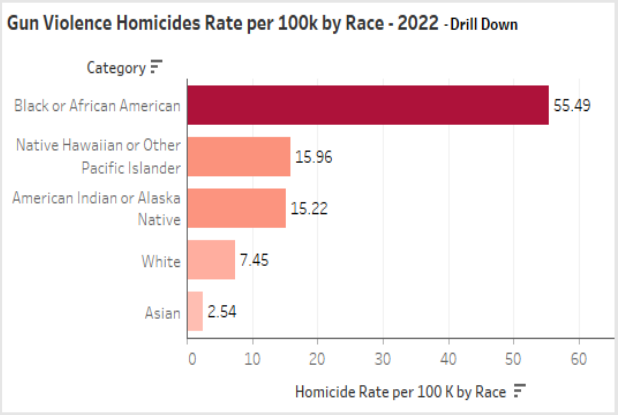


3. Demographic Patterns in Gun Violence Homicides

The data reveal significant demographic disparities in gun violence homicide rates across different age and racial groups:

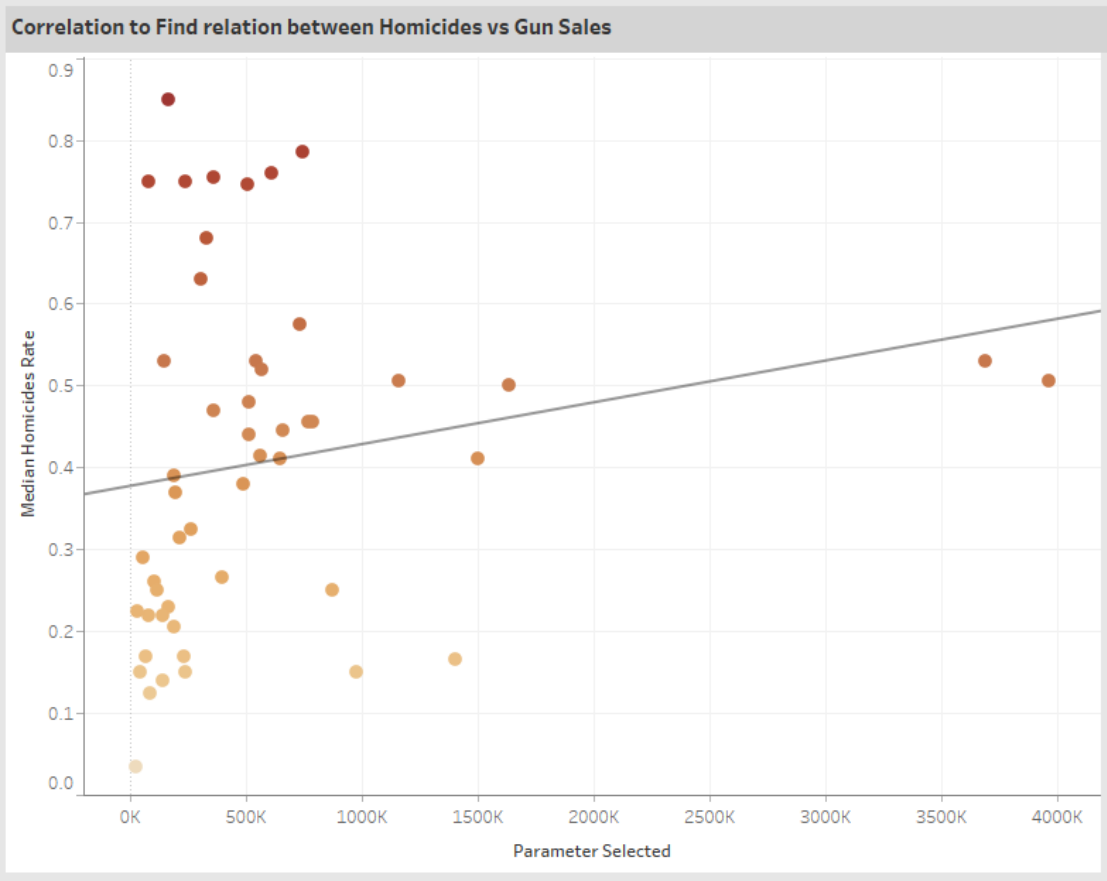
- **Age Group**: In 2022, the highest gun homicide rate is observed among individuals aged 20-60, with a rate of 7.89 per 100,000, followed by those aged 1-20 at 4.53. The rate drops significantly for the 60+ age group (0.86). This suggests that younger and middle-aged individuals are more vulnerable to gun violence, possibly due to greater exposure to high-risk environments or interpersonal violence.
- **Race**: Racial disparities in gun violence homicides are stark. Black or African American individuals face the highest rate (55.49 per 100,000), which is disproportionately higher than for other racial groups. Native Hawaiian or Other Pacific Islanders (15.96), American Indian or Alaska Native (15.22), and White individuals (7.45) follow. Asian individuals experience the lowest rate at 2.54 per 100,000. These figures reflect systemic socioeconomic inequalities and underline the need for targeted interventions in communities disproportionately impacted by gun violence.





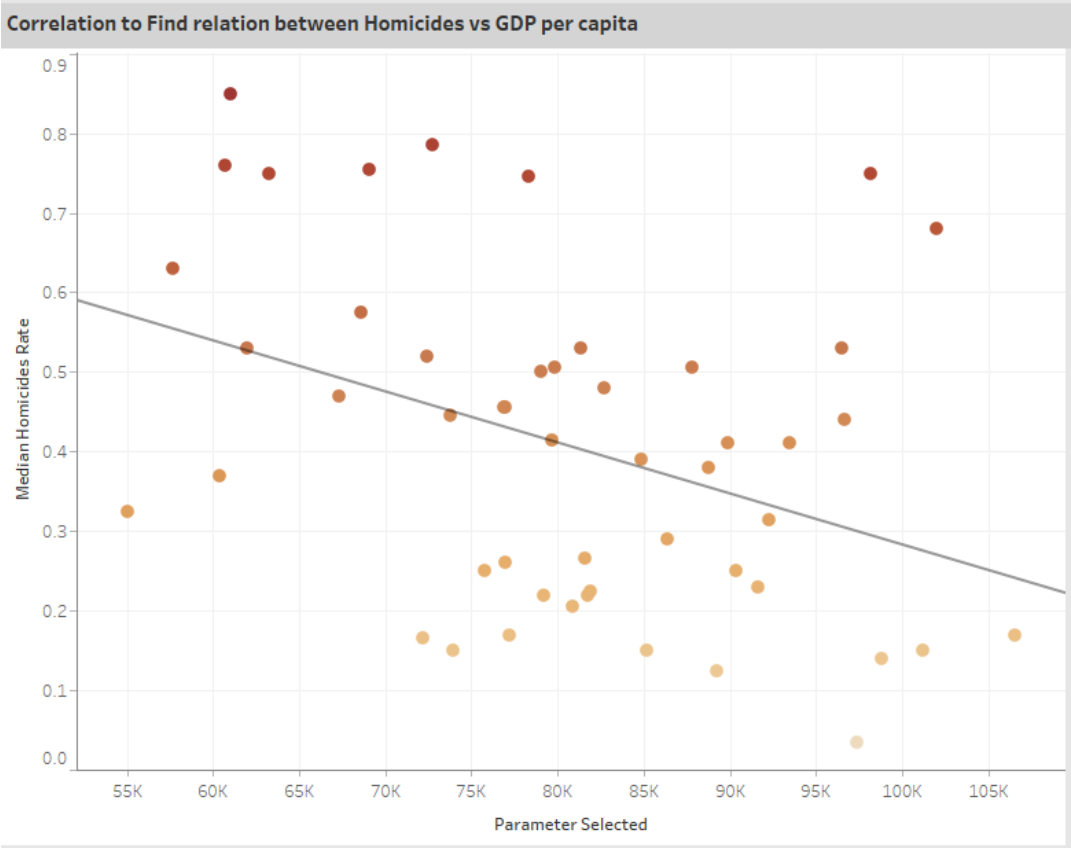
4. Correlation Between Gun Sales and Gun Violence Homicides

The analysis of gun sales versus gun homicide rates across U.S. states reveals a potential positive correlation, as states with higher parameter calculations (indicating higher gun sales) tend to show elevated homicide rates. For instance, states like Illinois, Pennsylvania, and Kentucky report higher homicide rates alongside significant gun sales, suggesting that increased firearm availability may correspond with increased gun-related homicides. In contrast, states with low parameter calculations, such as Hawaii and Vermont, show comparatively low homicide rates. This trend supports the hypothesis that higher gun sales may contribute to an increase in gun-related violence, although other socio-economic factors could also influence these rates.



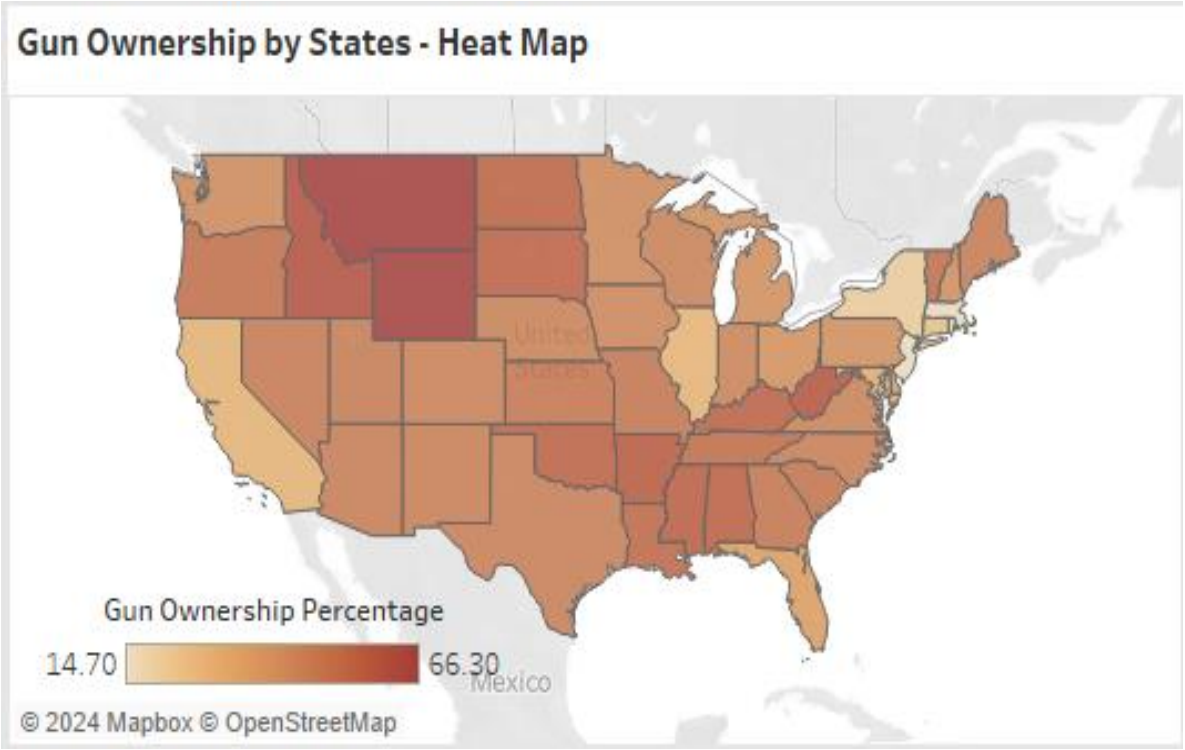
5. Correlation Between GDPs Per Capita and Gun Violence Homicides

Examining the relationship between GDPs per capita and gun violence homicide rates reveals a complex picture. High-income states do not consistently show lower gun violence homicide rates, indicating that economic affluence alone does not prevent gun violence. Instead, factors such as social inequality, urbanization, and local gun policies may be more decisive in influencing gun violence rates. Thus, while economic prosperity can provide resources for effective law enforcement and community support programs, a comprehensive approach is required to mitigate gun violence.



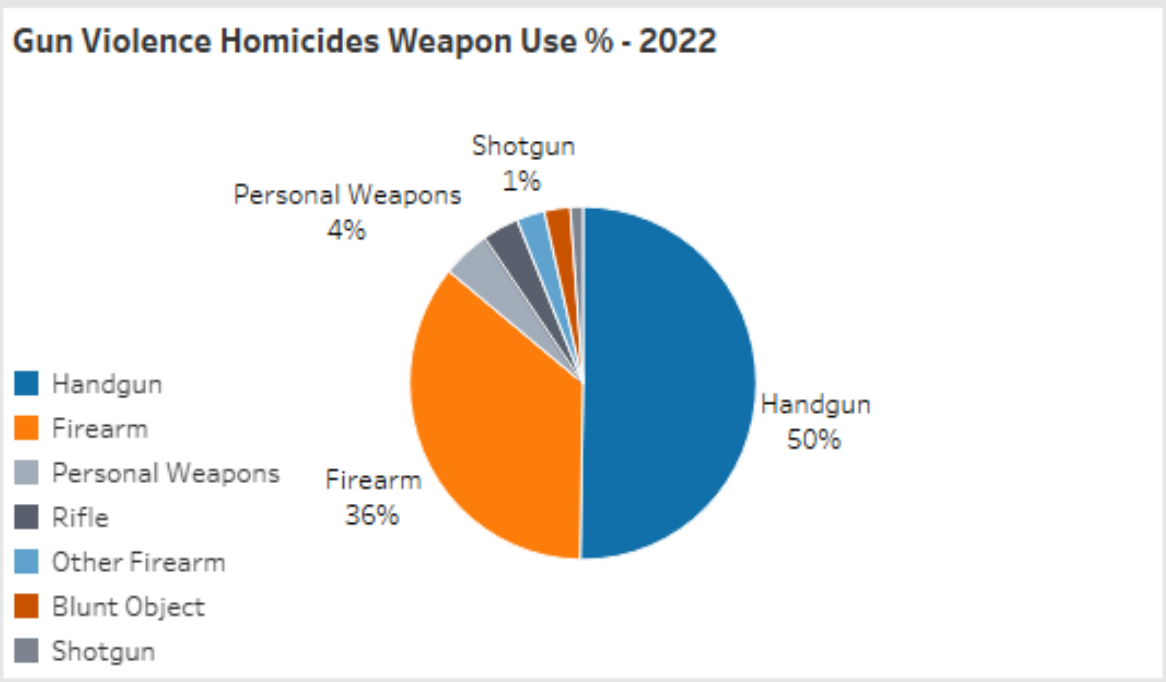
6. Gun Ownership Rates by State

A state-by-state heat map of gun ownership rates in 2022 further contextualizes gun violence. States with high ownership rates, such as Montana (66.3%), Wyoming (66.2%), and Alaska (64.5%), do not necessarily correlate with the highest homicide rates. For example, while Wyoming has high gun ownership, its homicide rate is among the lowest. This suggests that high gun ownership alone does not directly result in higher gun violence; rather, factors such as responsible ownership, storage practices, and cultural attitudes toward firearms likely mediate this relationship.



7. Types of Weapons Used in Gun Violence Homicides

In terms of weapon type, handguns are the predominant firearm involved in gun-related homicides, accounting for 54.56% of cases in 2022. This is followed by other types of firearms (30.72%), personal weapons like fists (5.22%), and blunt objects (3.15%). The dominance of handguns highlights the need for targeted policies on handgun accessibility and safety measures, as they are the most common instrument of lethal violence. Addressing handgun misuse through stricter regulations and community education can play a key role in reducing overall gun violence. These statistics also highlight the importance of better tracking and monitoring of handgun sales and ownership.



5. Key Findings

- **Geographic Disparities:** Gun violence homicide rates vary significantly across U.S. states, with the District of Columbia, Alaska, and New Mexico having the highest rates in 2022. Conversely, states like Wyoming, Nebraska, and Rhode Island report much lower rates. These disparities may reflect differences in state regulations, cultural attitudes, and socioeconomic conditions.
- **Increasing Trend Since 2020:** From 2015 to 2019, homicide rates remained relatively stable, but a noticeable spike occurred in 2020, possibly linked to the COVID-19 pandemic's economic and social impacts. Rates peaked in 2022 before a slight decline in 2023.
- **Demographic Patterns:** Younger and middle-aged adults (20-60 years) face the highest homicide rates. Stark racial disparities exist, with Black or African American individuals experiencing rates significantly higher than other groups, reflecting systemic socioeconomic inequalities.
- **Gun Sales Correlation:** States with higher gun sales, such as Illinois and Pennsylvania, often report higher homicide rates, suggesting a possible link between firearm availability and gun violence. However, other factors are likely to contribute to this correlation.
- **Economic Factors and Violence:** High GDP per capita does not consistently correlate with lower gun violence, indicating that economic wealth alone does not prevent gun-related homicides. Social inequality and local gun policies appear to play more decisive roles.
- **Gun Ownership Rates and Violence:** States with high gun ownership, like Montana and Wyoming, do not always have high homicide rates, suggesting that responsible ownership and cultural factors might moderate the impact of gun availability.

- **Weapon Types in Homicides:** Handguns are involved in most gun-related homicides (54.56%), highlighting the importance of handgun-specific safety policies.

6. Recommendations and Implementation

- **Policy Reforms:** States with high gun violence rates should consider policy adjustments, such as stricter background checks and restrictions on gun sales.
- **Targeted Interventions for Youth:** Programs focusing on young adults, especially in high-risk states, can help mitigate gun violence rates among this demographic.
- **Community-Based Programs in Vulnerable Areas:** Implement community-based initiatives to support Black and African American neighborhoods, addressing socio-economic disparities that contribute to gun violence.
- **Stricter Gun Sale Regulations**: Implement regulations that limit gun sales during identified high-risk periods, which can be aligned with observed spikes in homicides.

7. Conclusion

In conclusion, the analysis of gun sales and gun-related homicide rates across U.S. states highlights a concerning correlation: as gun sales increase, so does the likelihood of higher homicide rates. States with substantial gun sales figures, such as Illinois, Pennsylvania, and Kentucky, report elevated homicide rates, which suggests that increased access to firearms may exacerbate gun violence. Conversely, states with lower gun sales, such as Hawaii and Vermont, tend to have lower

homicide rates, pointing to the possibility that limiting gun availability could contribute to lower incidents of gun violence.

However, while this trend underscores a link between gun availability and violence, it is essential to acknowledge other contributing factors. Socio-economic conditions, cultural influences, law enforcement practices, and mental health support systems vary by state and could also impact these rates. Thus, addressing gun violence may require a multi-faceted approach, including better regulations, community interventions, and support systems to reduce dependency on firearms and create safer communities. Future research should delve deeper into these factors to develop well-rounded, data-driven policy recommendations for reducing gun violence.

8. Additional Research Questions

1. What socio-economic factors contribute to higher gun violence rates in certain states?
2. How do mental health services impact gun violence rates across age groups?
3. What is the impact of local law enforcement practices on gun violence trends?
4. How does media portrayal of gun violence affect public perception and policy?

9. References

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