

Understanding the Scale of Gun Violence in the USA: Exploratory Approach for Mass Shootings

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Abstract - The following Data Visualization project aims to shed some light on one of the most relevant issues faced by the United States in the current times: gun violence. Through clean, informative, and interactive visualizations, we'll portray trends, magnitude, fatalities, and overall facts about the role of firearms primarily related to mass shootings. Our goal is to increase awareness about gun violence's wounding consequences and to educate readers, encouraging informed debate and action.

Keywords - NRA, Gun Violence, Weapon, Mass Shootings, Visualization, Tableau.

I. INTRODUCTION

There is undeniable information that demonstrates the United States of America is facing severe difficulties concerning gun violence and safety. While this is not a new issue for the country, there is a growing sense among American communities that the situation has intensified significantly during the last couple of years. Unfortunately, despite the increasing rates of mass shootings, many of which have occurred on school campuses, the government has shown little interest in taking significant measures to address this issue.

There is an ongoing debate as to whether the root of the problem lies in regulatory aspects, social burdens, or mental health. However, there is a general lack of a reliable and transparent source of information on the topic, especially one centralized. The FBI's Crime Data Explorer is the source of information that comes closer to our criteria. However, filtering incidents under the Mass Shooting umbrella is still impossible. This makes it difficult to conduct objective and comprehensive research on the issue.

A. Motivation

As the shootings have become such a recurring issue; we understand that education on the subject could profoundly affect individuals, communities, and social groups by raising awareness and providing evidence-based and unbiased sources, as this investigation itself. Education on this topic is vital to motivate effective responses from authorities and individuals.

This paper is divided as follows: Section II introduces the testing hypotheses of our research, which are divided into the areas discussed before regulatory aspects, social burdens, and mental health. These hypotheses are based on the authors' preconceptions of this issue. Section III explains the datasets used in this paper, followed by Section IV, where we describe the steps taken for data preprocessing before our analysis. Section V presents a series of Tableau visualizations used to draw conclusions, which are presented in Section VI of this paper.

II. PRECONCEIVED HYPOTHESIS

This research aims to conduct an exploratory investigation on mass shootings in the USA. Although some generally known preconceptions around the issue's root define people's understanding of the why and the next steps to address it. We defined these hypotheses based on the authors' idea of the general population's preconceptions around the reason behind the occurrence of mass shootings. The hypothesis focuses on the most commonly discussed attributes related to gun violence:

- *Race:* Most mass shootings are committed by white individuals.
- *Gender:* Mass shootings are primarily committed by men.

- *Gun regulation*: States with more robust gun governance experience fewer mass shootings.
- *Mental health*: Most shooters do not experience mental health issues.

III. DATA SOURCE(S)

For analyzing the mass shooting, we relied on two main data sources:

A. Stanford_MSA_Database [1]: This is the primary source of information for the exploratory analysis we conducted. It resulted from a project started by Stanford University in 2012 and recorded historical data back to 1966. Even though it was suspended in 2016 due to resource restrictions, it still represents one of the most reliable data related to gun violence in the USA regarding attributes and research depth.

B. Gun_Violence_Archive [2]: The Gun Violence Archive represents the major source of information for actual data, this dataset allowed us to portray the current situation and gather insights missed by the Stanford timeframe. For reference, this data was downloaded on April 2029, 2023.

Another potential source that can be used for further analysis is the Mother Jones Mass Shootings from 1982 to 2023, one of the first open-source databases documenting mass shootings. [3]

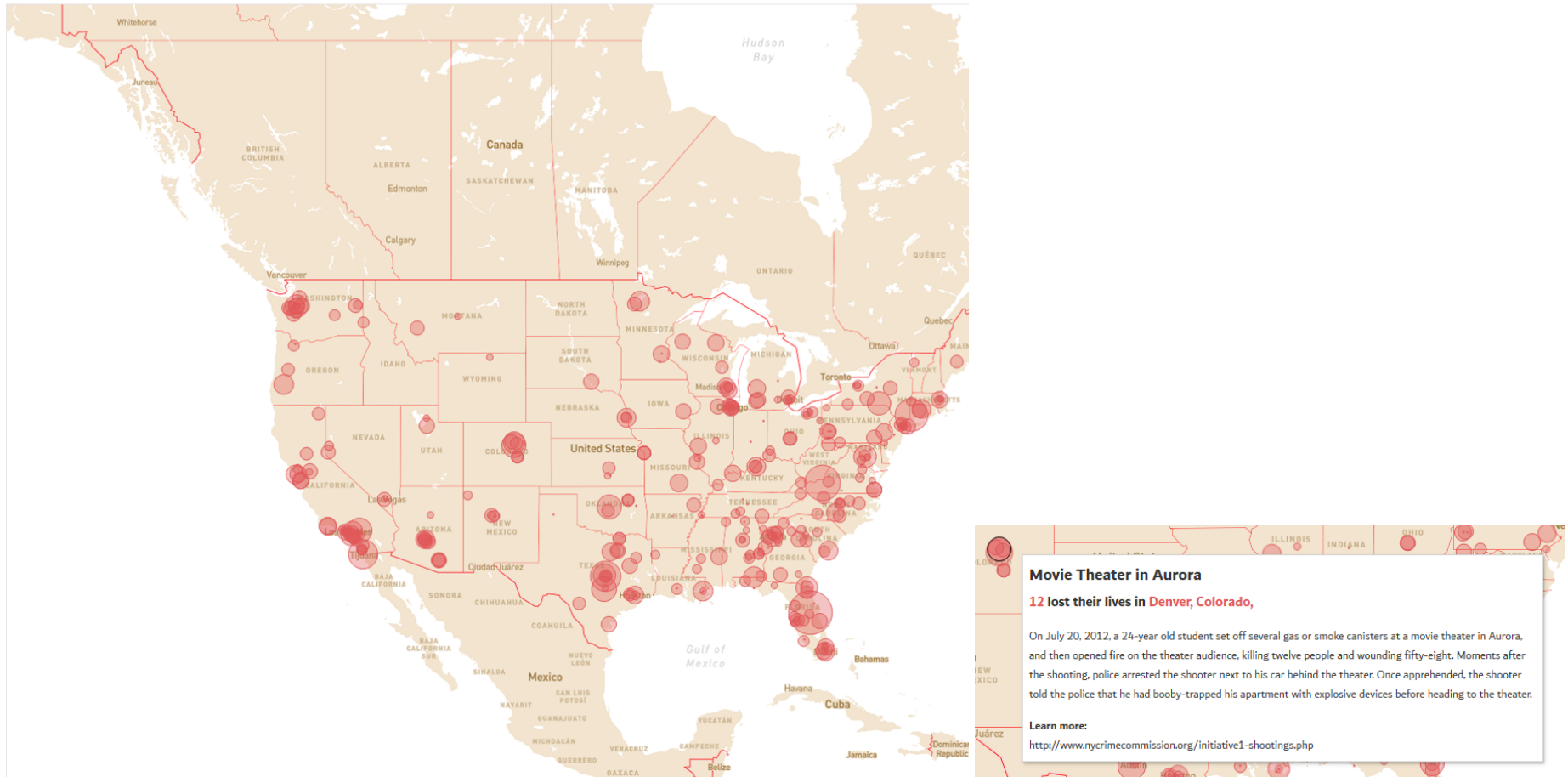
IV. PRE-PROCESSING STEPS

To ensure data accuracy and quality, we used Python to clean our data, where we analyzed the number of null values and the distribution of the value columns. The used datasets were already cleaned based on our Python analysis. However, we noticed that not all the data points were displayed during our map visualization. Using Python, we determined that a certain number of cases had the same latitude and longitude, indicating that the location was not the exact location but the general latitude and longitude of the state or city. To address this issue and ensure that all data points were visible on our visualization, we decrease the opacity of the data points to show the density of points in a given area.

V. DEVELOPED VISUALS

A. State Distribution for Mass Shootings (Map)

State Distribution for **Mass Shootings**

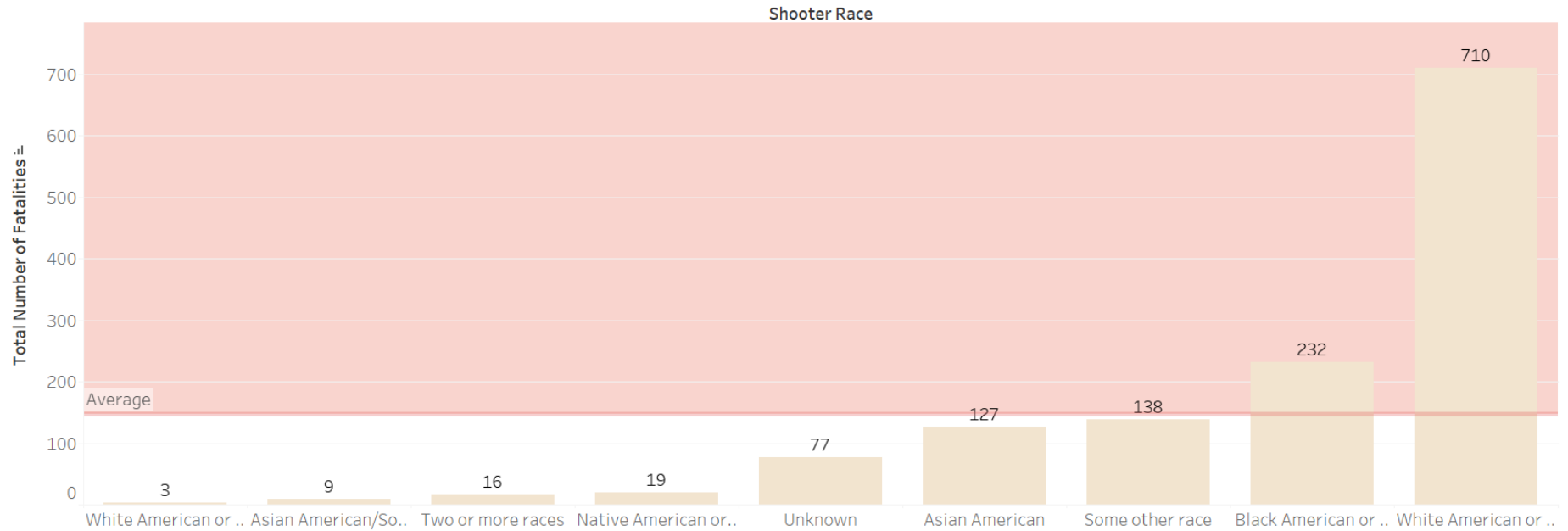


There's no clear pattern for mass shootings; the frequency of these incidents can be influenced by various factors, including changes in gun laws, mental health policies, and socioeconomic conditions. But as we can see, there's a higher frequency in the following states: California, Florida, Texas, Illinois, and Ohio, in which we can infer that the density of the population is one of the factors (mass shootings are more likely to happen in urban areas, with more populated cities). The states with a higher frequency of mass shootings have relatively lax gun laws and socioeconomic factors such as race, mental illness (and access to healthcare), and social isolation.

Additionally, hovering on any point in this visualization will communicate the story of how the event developed, including fatalities, dates, and descriptions.

B. Fatalities/ Shooter Race

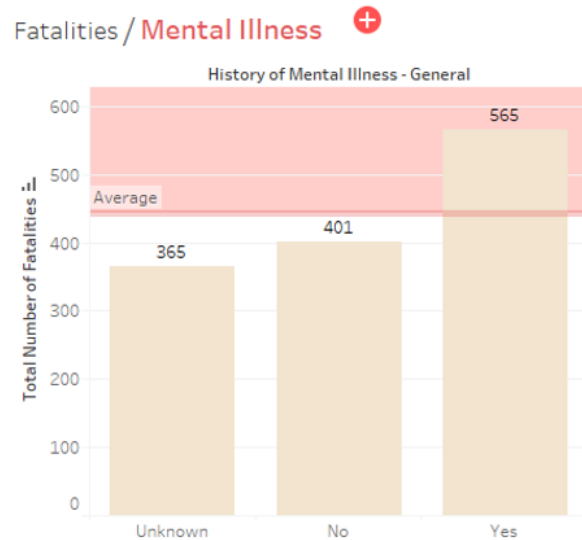
Fatalities / Shooter Race



White individuals perpetrate the majority of mass shootings in the United States. Of the 1331 fatalities registered in our data, (710 fatalities) 53% were committed by white individuals. There's no simple answer why any individual may proceed with a mass shooting, but here are some inferences of why white individuals are more prone: access to firearms (white individuals have greater access in the United States than any other demographic group according to the National Institute of Justice [4]), extremist ideologies such as white supremacists, resentment for LGBTQ+ or anti-government sentiment, or last but not least the lack of health access due to the prices of insurances leading to evolved mental issues.

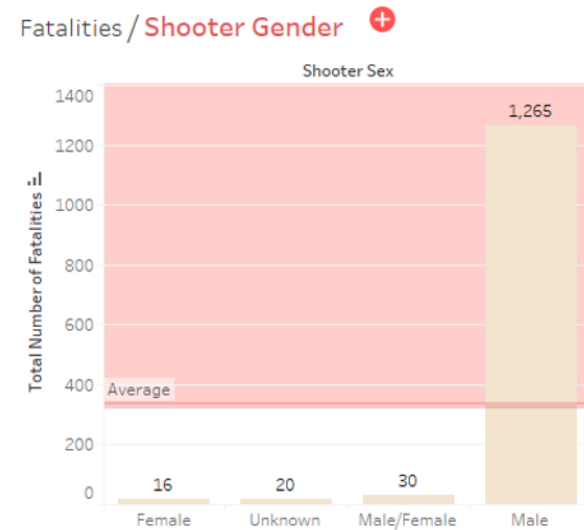
It's important to note that any individual of any race can commit mass shootings; for example, there have been instances of mass shootings committed by individuals who identify as black or African American. These incidents are relatively rare compared to the number of mass shootings in the United States, representing 17% of the fatalities. That said, it is essential to note that 60% of the US population identifies as White, implying that only white individuals could skew these results based on demographic distribution. When considering population density, they maintain that position but in a more "normalized" fashion.

C. Fatalities/Mental Illness



Individuals with mental illness may be overrepresented among perpetrators of mass shootings. Out of the 1331 fatalities, 565 of them, the shooter had a history of some sort of mental illness. It's also important to recognize that mental health is just one aspect of a complex and multifaceted issue and that addressing gun violence requires a comprehensive approach that takes into account the various factors that contribute to its occurrence, including access to firearms, social isolation, and exposure to violence. And also the perpetrators may have difficulty accessing appropriate treatment or support, which can exacerbate their symptoms and contribute to their risk of engaging in violent behavior. Individuals with mental illness may be overrepresented among perpetrators of mass shootings. Out of the 1331 fatalities, 565 of them, the shooter had a history of some sort of mental illness. It's also important to recognize that mental health is just one aspect of a complex and multifaceted issue and that addressing gun violence requires a comprehensive approach that takes into account the various factors that contribute to its occurrence, including access to firearms, social isolation, and exposure to violence. And also the perpetrators may have difficulty accessing appropriate treatment or support, which can exacerbate their symptoms and contribute to their risk of engaging in violent behavior.

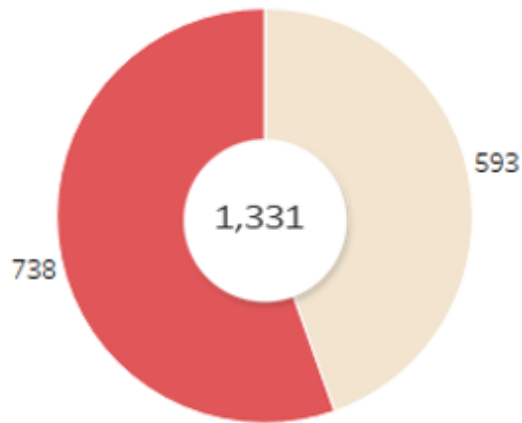
D. Fatalities/Shooter Gender



The majority of the mass shootings fatalities are caused by men, 95% of them to be more specific. Social and cultural factors may play a role, such as traditional gender roles that encourage men to be more aggressive and dominant, or societal pressures to conform to certain expectations of masculinity.

E. Weapon Type Impact

Weapon Type Impact



"Lethal" Weapons Used

- False
- True

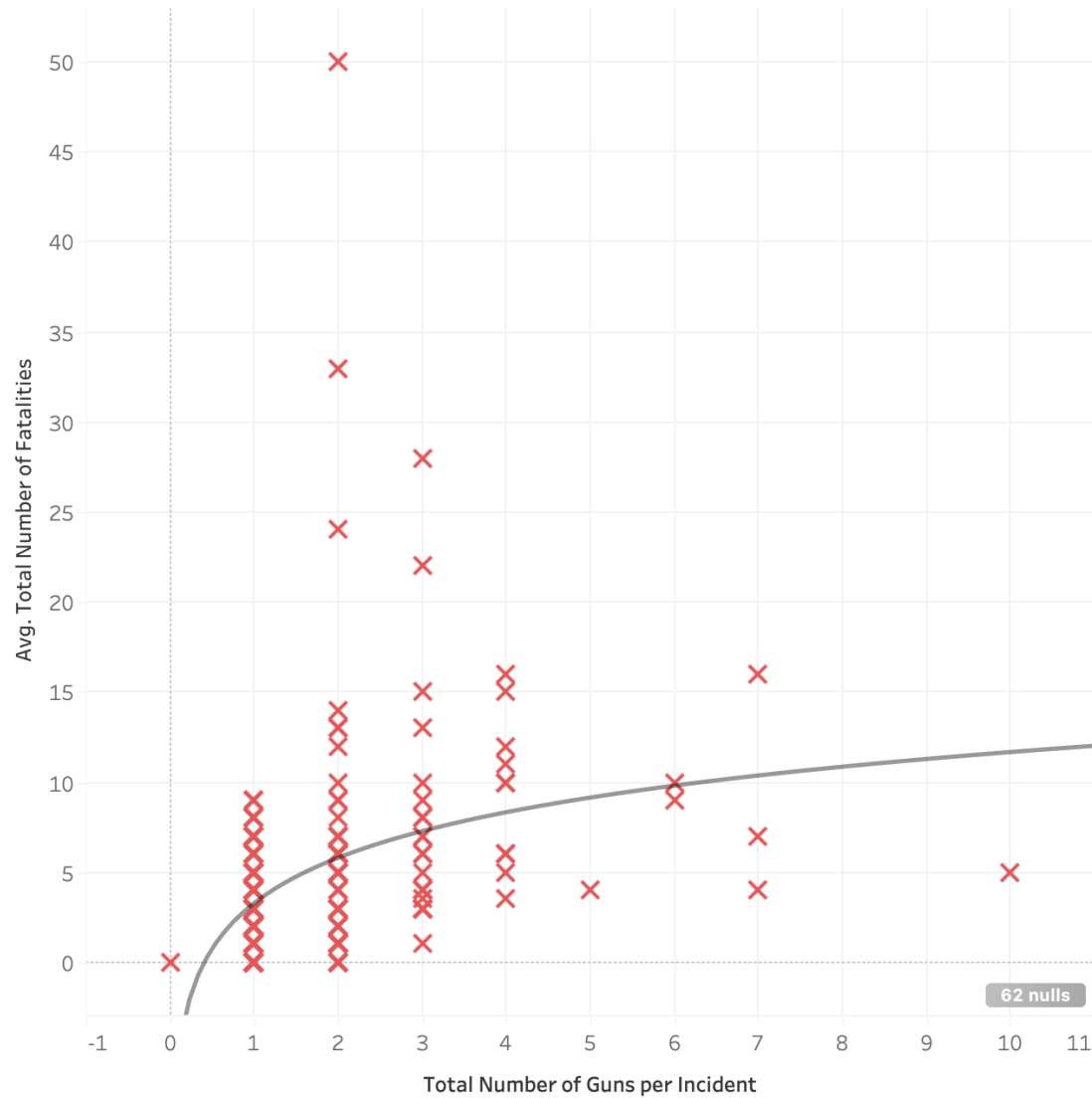
The use of lethal weapons is a defining characteristic of mass shootings. In the United States, firearms are the most common weapon used in mass shootings, and are often responsible for the majority of fatalities. Out of 1331, 55% of the fatalities were because of lethal weapons.

Supporters of gun control advocate for stricter regulations on firearms as a means of preventing mass shootings and reducing gun violence overall. While, advocates of gun rights argue that such regulations infringe on individuals' Second Amendment rights and would not be effective in reducing violence. This debate highlights the tension between individual rights and public safety, as well as the complex social and political factors that contribute to gun violence.

We also conducted the experiment of comparing states with similar populations but different grades of gun governance, Florida 21.78 million and New York 19.84 million, grade C and A respectively in terms of gun law legislation according to an analysis run by Wisevoter. Florida turns out to have 129 incidents out of which 82% involved lethal weapons like shotgun, long rifles and long semi-autos. New York, which is the state with stronger governance out of the two, has only experienced 44 incidents over the same period of time and only 30% of them involved the previously mentioned lethal guns. A difference of 52% for comparable states in terms of population, this idea backs up the argument of having stronger gun law resulting in fewer mass shootings.

For better understanding it is good to note that we defined as Lethal the following types of weapons: Automatic, Rifle and Automatic guns.

F. Total Number of Fatalities vs Total number of weapons



We can see that the severity of a mass shooting can be influenced by a variety of factors, including the number and type of weapons used, the shooter's tactics and skill, the location and setting of the shooting, and the availability of medical care and emergency responders.

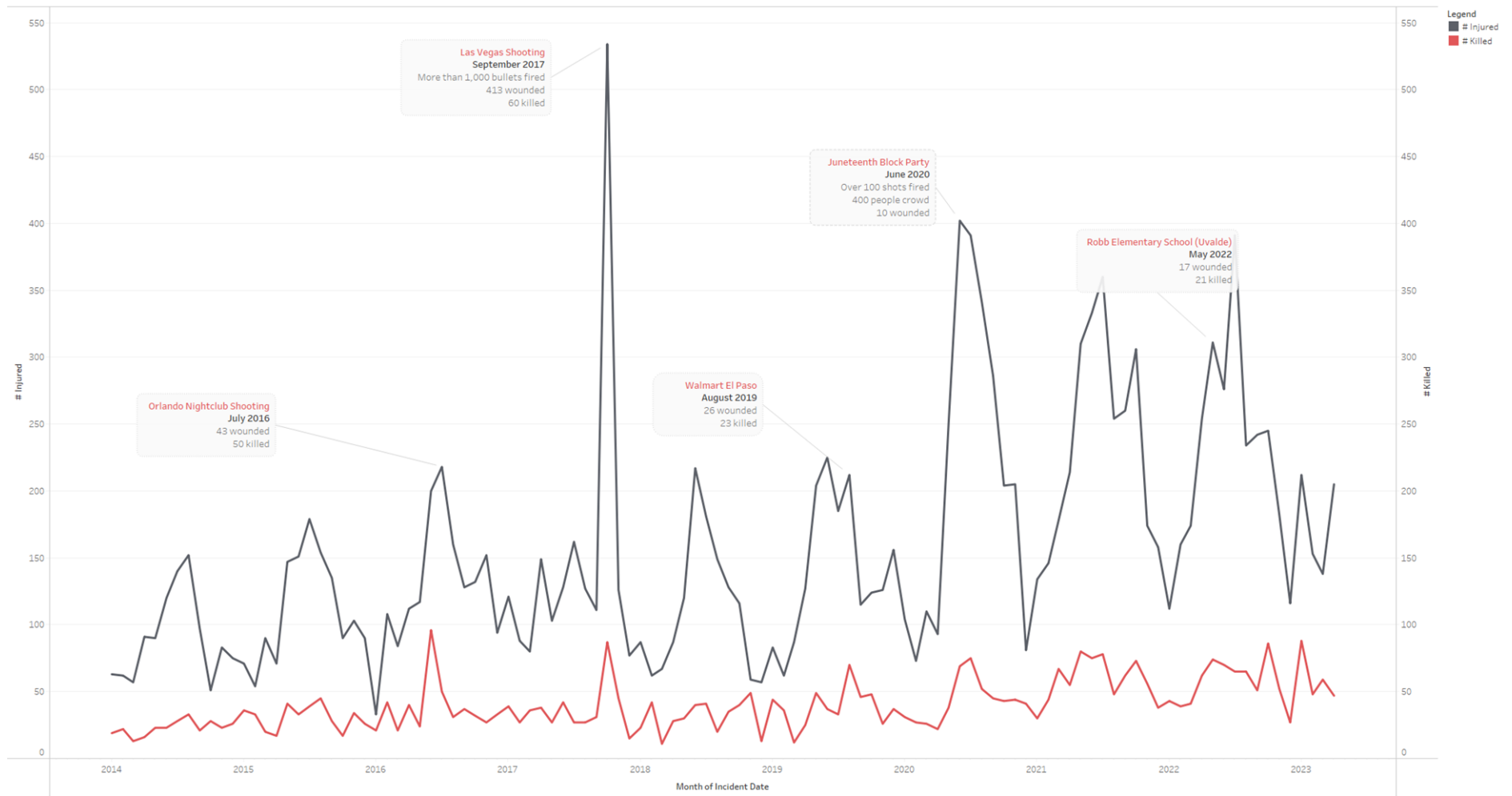
In some cases, a single firearm can be used to cause a significant number of fatalities, while in other cases, multiple firearms may be used but the number of fatalities is relatively low. Additionally, other factors such as the shooter's mental state, motive, and planning can also influence the severity of a mass shooting.

It's also worth noting that the number of fatalities and the number of weapons used may not always be accurately reported or documented, which can make it difficult to draw definitive conclusions about the relationship between these factors in mass shootings.

G. No. Fatalities vd No. Injuries

No. Fatalities & No. Injuries

Data points with high double spikes represent deadly and crowded incidents. Single spikes on **injuries** normally represent precision or a high quantity of incidents for that date.

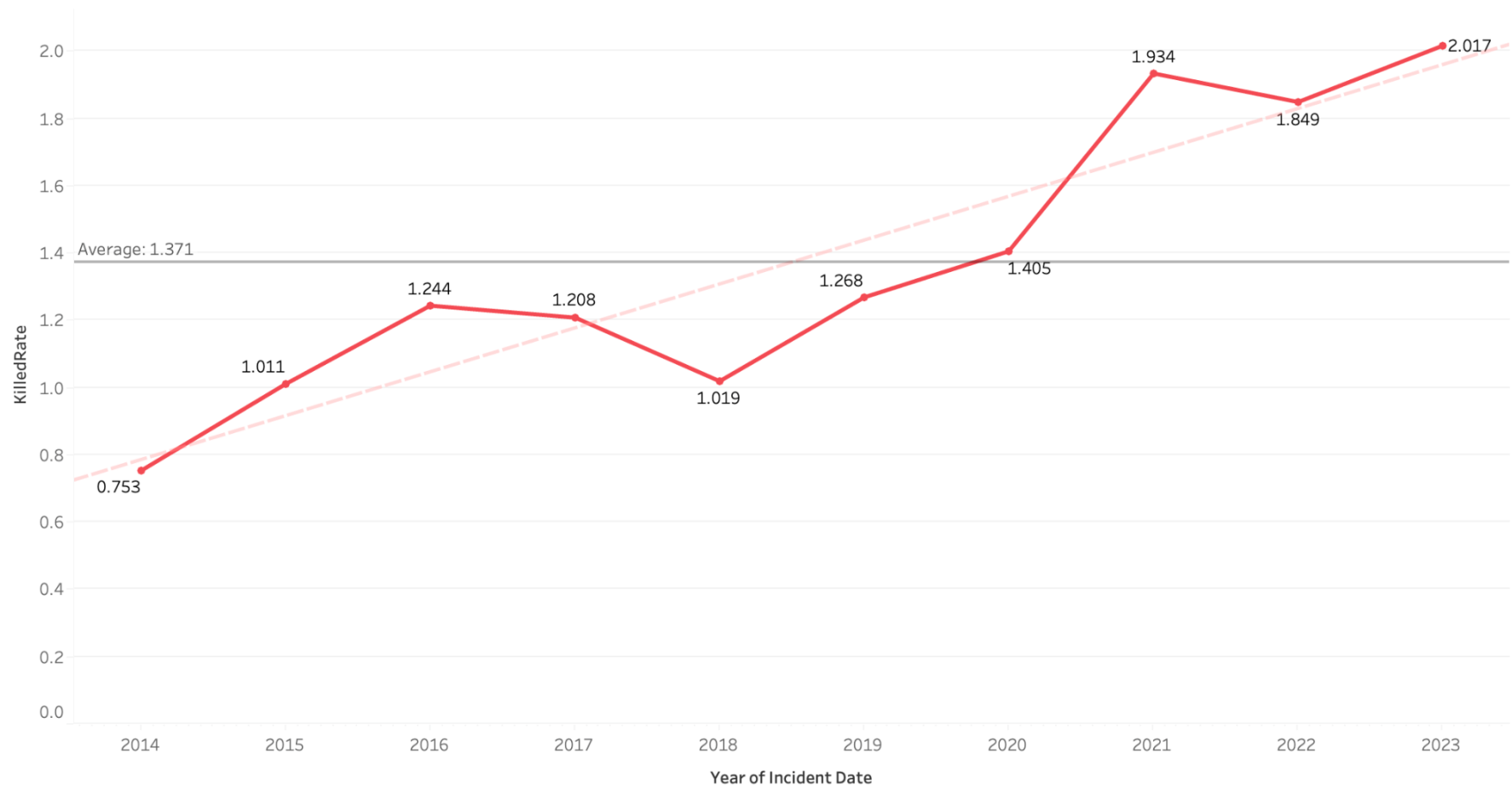


Based on the visualization above we can see that there were three times as many injuries as fatalities.

H. Fatalities rate per year

Fatalities rate per year

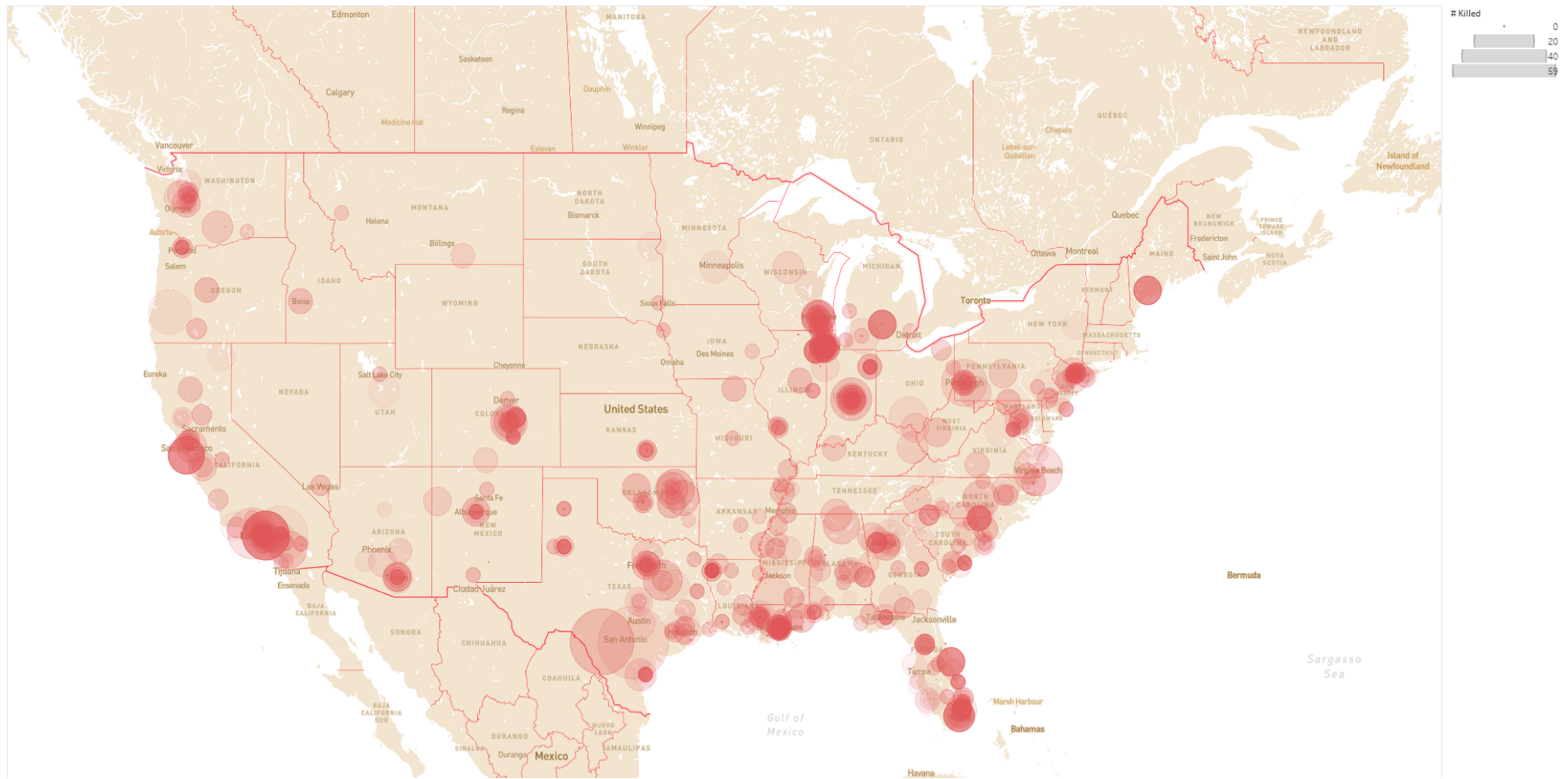
The fatality rate was calculated using the formula: $\# \text{ Killed} / \text{Days In Year}$



There has been an upward trend in the number of mass shootings in the United States over the past several decades. While the number of incidents can vary widely from year to year, the overall trend suggests that mass shootings are becoming more frequent.

I. Yearly Fatality Distribution

Yearly fatality distribution



This map shows an animation of the running total of mass shootings per year. We can see that most of the yearly fatalities distribution have a concentration on the East Side of the USA.

VI. CONCLUSIONS

In conclusion, the issue of mass shootings in the United States has become a matter of great concern and showing reliable and comprehensive insights can be difficult. Through our analysis of various hypotheses, it is clear that factors such as race, gender, gun regulation, and mental health may all play a role in these events, also we confirmed 3 out of our 4 preconceived hypothesis, making false the mental health one where most shooters do NOT experience mental illness, based on our data and analysis they do.

Our findings indicate that the frequency of mass shootings can be influenced by a range of factors, including changes in gun laws, mental health policies, and socio-economic conditions. Although the majority of mass shootings are committed by white males, it is important to recognize that any individual of any race can be a perpetrator. Furthermore, our research suggests that individuals with mental illness are overrepresented among perpetrators of mass shootings, and social and cultural factors contribute to these events. We have also found that the use of firearms is the most common weapon used in mass shootings and is often responsible for the majority of fatalities.

Overall, our report highlights the need for a comprehensive understanding of the complex factors that contribute to mass shootings to develop effective prevention strategies and minimize the harm caused by these events.

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