

The Impact of Legislation on Gun Violence in the US

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ABSTRACT

The purpose of this study was to gain an understanding of how various states' approaches towards gun restrictions can affect gun violence rates. We investigated the relationship between gun death rates, background checks, and legislative changes, and aimed to find trends and connections between these. We first created an interactive heatmap in Tableau that shows the percent change in death rate between 2016-2021 for each state in the US, with tooltips that provide the raw data for users to investigate. We then selected a small subset of states who had interesting changes to investigate further, where we analyzed how their legislative changes each year impacted their death rates and background check rates. We found that overall, the average percent change in the nation was an increase of 24.2

1 INTRODUCTION

On October 1, 2017, a shooting rampage at a Las Vegas music concert hall killed more than 60 people and injured more than 500 people. At that time, about 40,000 spectators were gathered at the concert hall, and the suspect was killed after a battle with the police, but it is said to be one of the most tragic mass shootings ever. This tragic event has renewed the urgency of debate over gun laws and has led to changes in legislation in several states, including Nevada.

In our study, these events provide context as we explore how changes in laws relate to changes in gun violence rates in several states. By examining data such as gun background checks, a reliable indicator of gun purchases, we can measure the effectiveness of these laws in real-time.

Gun violence remains a controversial and pressing issue in the United States, and each state is adopting different legislative approaches to gun control. This study analyzes the impact of these different approaches on gun violence rates from 2016 to 2021, highlighting states that have seen significant changes. We will use data visualization tools, including interactive maps and two-axis line graphs, to represent the impact of gun laws on gun-related deaths, reflecting changes in policy and enforcement.

2 RELATED RESEARCH

2.1 Background on Gun Policy Research

Swanson, et al. conducted a wide literature review of prior research relating to the relationship between mental illness and gun violence [1]. Swanson, et al. found that the vast majority of people with serious mental illnesses are not violent, but mental illness is associated with the risk of suicide, which accounts for a large portion of gun fatalities in the US [1]. Swanson, et al. do not provide specific policy recommendations for lawmakers, stating that they do not know in advance which policies will be the most effective at reducing gun violence and suicides [1]. However, they emphasize that future policies must balance commitment to public safety and respect for mentally ill individuals and their second-amendment rights [1].

A study published in the National Library of Medicine explores the relationship between the strictness of firearm laws and the incidence of firearm-related injuries and deaths across different states in the U.S., using data from the 2011 Nationwide Inpatient Sample database [2]. It finds that states with strict firearm laws (SFL) experience significantly lower rates of firearm-related injuries and mortalities compared to states with non-strict firearm laws (non-SFL) [2]. This study is pertinent to our project as it provides empirical evidence on the effectiveness of gun control laws, which can inform policy recommendations or advocacy strategies aimed at reducing gun violence, aligning with the goals of promoting safer community environments.

The research from Reeping et al. inspects the correlation between state-level gun law permissiveness, gun ownership rates, and the occurrence of mass shootings in the United States [3]. The study found that states with more permissive gun laws and higher rates of gun ownership experience significantly higher rates of mass shootings [3]. Specifically, a 10 unit increase in state gun law permissiveness was associated with an 11.5% increase in mass shootings, and a 10% increase in state gun ownership correlated with a 35.1% increase in mass shootings [3]. These results were consistent across various models and adjustments, highlighting a clear and robust association between looser gun regulations, higher gun ownership, and increased mass shooting incidents [3].

Sharkey et al. analyzed the relationship between gun regulations and the change in gun related mortality from 1991 to 2016 [4]. They found strong evidence that "restrictive state gun policies reduce overall gun deaths," and that each additional gun regulation caused -0.21 gun deaths per 100,000 individuals [4]. Specifically, they found that background checks and waiting periods for gun purchases were among the most impactful policies [4].

Case Studies On New Jersey and Maine We could not find year specific policy changes on New Jersey and Maine, as their changes to gun laws were outside of the time focus of our research studies. We decided to dig deeper on their existing gun policies to shed some light on the changes in their firearm related mortality data and firearm background checks completed.

New Jersey's gun law strength ranks as number seven according to Everytown Research and Policy and the state has a low rate of firearm death and firearm ownership as compared to other states [5]. New Jersey is also known as the first state to enact effective policies that regulate "ghost guns," which are firearms that cannot be traced [6]. In 2021, New Jersey had the 3rd lowest firearm related death rate in the United States, showing the effectiveness of its gun violence prevention policies [6]. New Jersey's extensive firearm related policies include evidence backed regulations focused on keeping firearms out of the wrong hands, prohibitions on assault weapons and high capacity magazines, license requirements for dealers, waiting periods and required trainings [5].

Maine has had few gun safety laws as compared to other states in the Northeast and ranks 25th in the United States for gun law strength [7]. Maine has very few laws regarding gun product safety which means that the state allows assault weapons, high capacity magazines, and has not instilled consumer safety measures into law [7]. Multiple bills aimed at tightening gun laws, such as requiring a waiting period for gun purchases, banning high-capacity magazines, and expanding background checks, have failed to pass the state legislature [8]. In 2019, Maine did pass a "red flag" law allowing

police to temporarily confiscate firearms from individuals deemed a threat, but it is considered a weaker version compared to other states as only law enforcement can petition for the order, not family members [9]. Furthermore, Maine remains a "permitless carry" state, allowing concealed handguns without a permit, and does not require background checks for private gun sales or transfers [9]. After the 2023 Lewiston mass shooting in Maine, the state has passed regulations that require background checks on unlicensed gun sales and the state maintains a lower gun violence rate which could be influenced by the gun safety measures that surrounding states implemented [7].

3 DESCRIPTION & JUSTIFICATION

3.1 Interactive Data Visualization

In this study, covering data from 2016 to 2021, we investigate the complex relationships between gun laws and gun-related fatalities in many US states [10]. We aimed to provide a clear and interactive picture of trends and changes in gun-related death data, and investigate how legislative changes impacted this data.

3.2 Sourcing and Structuring Firearm Data

We accessed the Centers for Disease Control data on firearm related mortality, which includes data from 2005-2021, but we limited the time frame to 2016-2021 since that did not have any gaps in data [10]. We also used background check data from the FBI's National Instant Criminal Background Check System (NICS) [11]. This data was logged monthly, but as we wanted to compare yearly changes, we calculated the totals for each year instead. Since background checks are required under federal law to purchase a firearm from a licensed dealer [12], this data was a good indication of how many attempts were made each year to purchase guns.

3.3 Design 1: Demographic Analysis in Tableau

We first chose to explore which states had the highest changes in gun deaths over time. We chose to use the age-adjusted death rate to calculate the percent change in death rate for each state, which adjusts for any confounding caused by age. We decided to use Tableau to visualize this in the form of a heatmap. We felt that a heatmap would be the best way to visualize this data since we were displaying data for each state, and we wanted viewers to be able to easily see differences in gun death rates between states. Importantly, we ensured that the tooltips contained all of the data that we anticipated a user would want to explore, such as the raw numbers of deaths in 2016 and 2021, as well as the rates that were calculated by the CDC. We selected a dark orange color scheme since red was too bright, but we still wanted to easily convey to the viewers that a greater increase was bad. We chose a light blue to represent the states whose gun death rates decreased, as blue is associated with cooling and decrease [10]. Overall, the map was designed to emphasize user-friendliness and data accessibility, making a large dataset understandable at a glance but also allowing users to investigate further if they wished.

This map served as the starting point for our research, as it helped us identify states that stood out. In particular, we singled out the states whose death rates decreased, as there were only three of them: New Hampshire, New Jersey, and West Virginia. Following this, we decided to also analyze the states with the highest death rates, as we felt that users would be interested in further investigating those states. These were Maine, New Mexico, and Mississippi. Analyzing the few states whose death rates decreased could potentially tell us which policies were effective at managing gun violence. In contrast, analyzing the states whose death rates increased the most could tell us which policies were least effective at managing gun violence. Interestingly, Massachusetts had exactly 0 change in death rate, so we decided to further analyze Massachusetts as well to see if there

were any important changes being obscured by our percent change calculation.

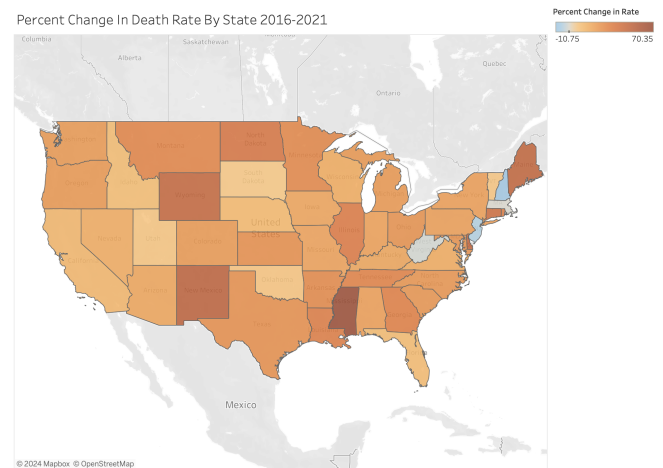


Figure 1: Interactive map of gun mortality rates across the U.S.

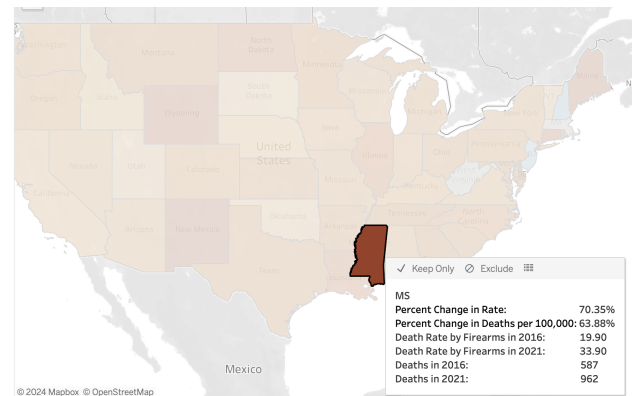


Figure 2: Tooltip Display on Gun Mortality Interactive Map

3.4 Design 2: Trend Analysis with Altair

After singling out the seven key states named above, we decided to conduct deeper investigations on the relationship between background check volumes and fatality rates. To do this, we used dual-axis line graphs created in Altair. We plotted the age-adjusted death rate on the left axis, and the total number of requested background checks on the right axis. As mentioned above, a background check is required in order to purchase a gun from a licensed dealer, so the background check trendline represented the number of guns that were attempted to be purchased in that year [11]. We specifically chose to use dual-axis line graphs to examine and emphasize the relationship (if any) between these two statistics, as this format makes it easier for users to see matching trends. This important visual comparison sheds light on the potential correlation between changes in death rates and the number of firearms purchased. States like New Hampshire and New Mexico, for instance, have various patterns in death rates despite having comparable legislative frameworks, indicating the possibility that additional socioeconomic or cultural factors may also have a major influence on these results.

We also conducted further policy research on the states' firearm policy changes to shed further light on what could have caused

changes in firearm related mortality rates and/or increases or decreases in estimated total firearm purchases. We largely used information from the website gun.laws.com, which listed the important legislative changes or considerations each state made per year that were related to firearms. We corroborated this information with the state's gun handbook, if it was available online. We put this information in the tooltips on the trendlines, as this makes it easier for the user to make connections between the impact of specific legislative changes. This information, along with the death rate and background check data, effectively displays the impact of legislative changes that the states made each year.

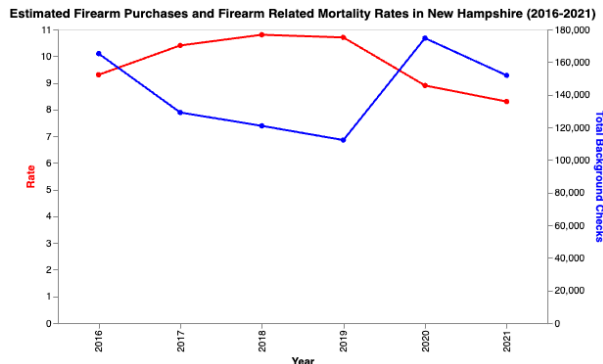


Figure 3: Dual-axis line graph showing trends in New Hampshire.

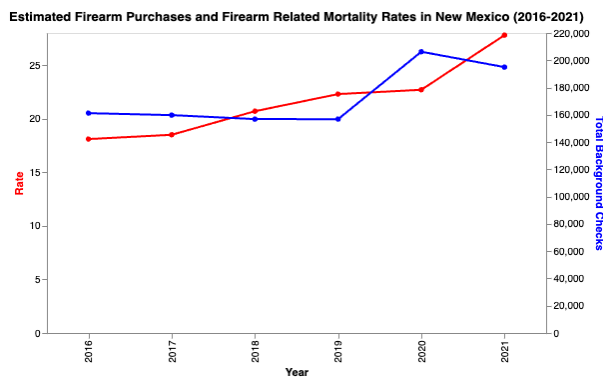


Figure 4: Dual-axis line graph showing trends in New Mexico.

4 DISCUSSION

This project used several visualizations and data sources to examine the impact of legislation on gun deaths, at both the state and national level. We found that the average percent change in age-adjusted death rate over 2016-2021 was 24.2%, which means that the vast majority of states experienced a rise in firearm-related deaths over this time period. It is also important to note the impact of outside factors: most notably, 2020 was an incredibly stressful year for many, with events such as the Covid-19 pandemic, protests against police brutality, and the presidential election. These were all sources of great unrest, and very likely contributed to an increase in many states' death rates.

Our findings relating to the impact of legislation are largely in line with what Sharkey and Kang found [4]. In general, the states whose gun deaths decreased were the ones who tightened background checks by increasing reporting to NICS, specifically for mental health and criminal records. They tended to have spikes in

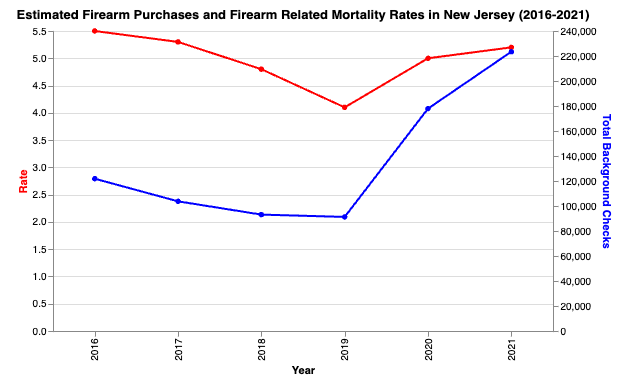


Figure 5: Dual-axis line graph showing trends in New Jersey.

background check requests the following year. However, the gun death rate generally did not increase nearly as much, indicating that these restrictions prevented many guns from falling into the wrong hands. In contrast, the states who did not have many laws restricting gun ownership were the states that saw high increases in death rates.

These findings show the effectiveness of tighter gun restrictions, and we believe that they should be applied at the federal level. In particular, lawmakers need to focus on increasing reporting of mental health data to NICS and making background checks more stringent, as states who did this seemed to have the most success with maintaining lower gun death rates. Thus, our findings show that the national problem of gun violence is not unmanageable, and simply increasing the stringency of background checks at the federal level would likely help to slow the increase of gun death rates.

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