**State Gun Laws and the Incidence of Mass Shootings in 2022**

Andra Kennedy

Western Governor’s University

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**Project Overview:**

**A1. Research Question or Organizational Need**

This project will look at the most recent data collected regarding mass shooting events in 2022 and compare them to the most recent gun control legislation implemented within each state. Specifically, this project will seek to determine if state gun laws have an impact on mass shooting events by comparing states with strict gun laws to states with weaker gun laws and the number of mass shootings occurring within each state. As the incidence of gun violence continues to rise in America, continuing to research and analyze gun violence trends within each state as it relates to state legislation may assist in finding solutions to decrease gun violence in America.

**A2. Context and Background**

It’s a brand-new year. While most Americans are still trying to adhere to New Year Resolutions, the United States is facing a deadly epidemic that unfortunately has become common place. As of the end of January 2023, there have been over 50 mass shootings in the United States. The daily average of mass shootings in the first month of 2023 is 1.68 (*Gun Violence Archive*, n.d.). With gun-related violence occurring daily in the United States, citizens once again face the question: ‘What can be done to reduce gun violence in America?’

Possible solutions to curb gun violence have been presented and debated for decades, leaving many Americans divided. It seems the one factor all Americans can agree on, is the need for increased safety for civilians and prevention of future events. Previous measures to curb gun violence include The Gun Control Act of 1968 and the Brady Handgun Violence Prevention Act of 1993. These measures placed limitations on individuals seeking to purchase firearms. As a result of these acts, requirements for gun purchases are limited by age, previous criminal and mental health history, and universal background checks when sold by licensed dealers. Background checks are managed via the Federal Bureau of Investigation’s National Instant Check System (FBI NICS), which is used to determine eligibility. These measures were put in place to limit firearm availability to individuals with malintent and potentially decrease gun-related violence.

Yet these measures are not without fault, and certain loopholes exist. For example, gun background checks may not be performed during private or online sales, as these transactions are typically not conducted by licensed dealers. Background checks are are not required during gun shows in some states, something often referred to as the “gun-show loophole”. The FBI’s NICS may not be consistently updated by local police departments, resulting in outdated and incorrect information. And while some states allow individuals to purchase a firearm without a waiting period, other states allow the purchase of a firearm once the waiting period has expired, whether or not the background check has been completed and verified (Merrefield, 2023; Masters, 2022). Others argue that gun control measures are only effective among law abiding citizens, pointing out individuals may still acquire guns via gifts, family and friends, private and black market sales, or by performing criminal acts such as theft (*Policies That Reduce Gun Violence: Firearm Purchaser Licensing*, 2021). Still, gun control measures are often touted as being the main component to reducing gun violence in America.

**A3. Summary of Published Works**

In efforts to determine which public measures are most effective in reducing gun violence, studies have been conducted to determine the effects of gun control laws on the incidence of gun-related violence.  A qualitative research review of 21 studies analyzing the relationship between gun legislation and subsequent gun violence found the overall consensus to be inconclusive. Overall research findings regarding dealer background checks had a limited to moderate impact on the incidence of gun violence (Charbonneau, 2018).

Yet another qualitative research review conducted in 2022 suggests universal background checks do result in decreases in gun violence, but only when combined with other, more restrictive gun laws, such as permit-to-purchase. These gun laws require individuals to obtain a permit from a local police department, complete with fingerprint background checks, and are considered a more thorough and in-depth background check. These background checks also increase the waiting period from 3 to 5 days to a 30-day time period (Merrefield, 2023).

In 2020, Webster et.al analyzed data containing the incidence of mass shootings in the United States from 1984 to 2017, and compared these incidents to state gun law regulations. They collected and documented which gun law regulations were enacted by date and type, and compared these to the incidence of mass shooting events by state. This study found states that required individuals to be licensed via comprehensive background checks, further supported by fingerprints, and in combination with state bans on firearms with large capacity magazines, resulted in significant decrease in mass shooting events. Other public measures, such as less in-depth background checks, allowing civilians to conceal carry firearms, and banning assault style firearms were not related to mass shooting events (Webster et. al., 2020).

Jehan et. al (2018) analyzed the relationship between gun-related hospitalizations and states with strict gun laws versus states with less strict gun laws. In this study, states were divided into two groups based on the Brady Center Score. The Brady Scorecards rate states from 0 to 100 points based on five areas associated with gun laws. States with a higher score are identified as having more strict gun laws while states with lower scores are identified as having weaker gun laws. Based on the Brady score and the dataset used for this analysis, only ten states were identified as having strict gun laws while thirty-four states were identified as having weak gun laws. Following the analysis, Jehan et. al. found states with weak gun laws had higher gun-related injuries and gun-related deaths than states with strict gun laws (Jehan et al., 2018).

Duchesne et. al (2022) conducted an analysis comparing state gun laws and the impact on mass shooting events from 2014 to 2021. Mass shootings were categorized as a gun-related event with at minimum 4 people injured or killed during a single event, as identified by the Gun Violence Archive. They utilized the Giffords Law Center categorization of state gun laws from 2013 to 2020. The Giffords Law Center analyzes and tracks state gun control legislation and assigns each state with a rating from ‘A’ to ‘F’. An ‘A’ rating indicates the state has the strictest gun laws while an ‘F’ rating indicates the state has the weakest gun laws. Results suggested state gun laws did not have an affect the incidence of mass shootings within the United States over the time period analyzed (Duchesne et. al., 2022).

**A4. Summary of Data Analytics Solution**

The purpose of this proposed project is to further the current research comparing gun laws by state and the incidence of gun violence. This project will perform data analyses using the most up-to-date data on gun violence via the Gun Violence Archive for Mass Shootings in 2022 as it compares to the Giffords Law Center categorization of gun laws by state for the year 2021. The Giffords State ranking for 2021 is the most recent ranking available at the time of this project, and comparing it to the mass shooting events in 2022 may be indicative of the effects the prior year laws have on gun violence. While the Webster et. al. study was very informative by evaluating gun violence as it relates to specific gun law categories, this project will focus primarily on overall state laws and gun violence. This project will be modeled similarly to the Duchesne et. al. using data from the same sources and could be interpreted as a small extension of that study. However, this project will include ANOVA statistical testing on this dataset to determine if there is a statistically significant difference between the state groups. Should the ANOVA testing not be the best fit for this dataset, this project may be modeled similar to the Jehan et. al. study by dividing the dataset into two groups rather than the five groups identified by Giffords Law Center. It may also be interesting to determine if there is a difference between the number of deaths and injuries within each state as it relates to state gun laws.

**A5. Benefit to Organization and Decision-Making Process**

With the continuing trend of gun violence in America, this project will contribute to the present data evaluating the effects of gun laws by state. By increasing the current research and knowledge base, states may be able to come up with effective measures that successfully decrease the incidence of gun violence in America.

**Data Analytics Plan**

**B1. Goals, Objectives, and Deliverables**

The goal of this project is to determine if state gun laws have an impact on mass shootings, using the most current mass shooting data from 2022, as compared to state gun law rankings from 2021.

The objectives for this goal are:

* To utilize descriptive analyses to find trend statistics by state.
* To utilize descriptive analyses to find trend statistics between states.
* To utilize descriptive analyses to find trend statistics between gun law grades of states, from states with strictest gun laws to states with least restrictive gun laws.
* To determine statistical significance between the incidence of mass shooting events as compared to states with strictest to least restrictive gun laws.

The deliverable for the above objectives will be a report with graphs, tables, and final statistical analyses to add to the current research base.

**B2. Scope of Project**

The scope of this research project is to determine if current state laws regarding gun control have an impact on the incidence of mass shootings in the year following legislative implementation. Using the most current and complete information, data from mass shootings occurring in the United States in 2022 will be compared to State Gun Laws as assessed and graded by the Giffords Law Center. Descriptive analysis will seek to identify trends and findings regarding state incidence of mass shootings. Statistical analyses will seek to determine if there is a statistically significant difference in the incidence of mass shootings by state gun law grades, from strict gun laws to weak gun laws. The scope of this project will only look at the dataset for mass shootings occurring in 2022. This project will not analyze data regarding other gun-related events occurring in 2022 and will not analyze mass shootings occurring in years prior to 2022, as these would be considered out of scope. No other objectives, tasks, or deliverables will be considered or completed, as these would be considered out of scope for this project.

**B3. Standard Methodology**

The Agile project planning methodology will be used for this project as it allows participants to make adjustments as needed. The Agile method is iterative and typically consists of five steps.

* Define: In this step, the research problem is clearly defined. The work required to complete the project is identified and workload required may be set in stages. For this project, the Define step includes the research and background information required to aid in defining the current project problem and research question to analyze.
* Design: This step outlines how the project will proceed and the stages required at each step. During this step, an appropriate dataset and other necessary components are identified to complete the project, as well as a general workflow of how the project will proceed.
* Build: This step begins making the design of the project a reality. This step will comprise the main work in the coding environment to prepare the dataset for testing. This step will also include identifying the appropriate model to use to test the dataset according to the research problem parameters.
* Test: The fourth step will be to test the dataset according to the research problem and make corrections as needed based on results.
* Release: This step delivers the finished product. For this project, the finished product will be a written report communicating research findings.

Although the Agile method typically follows these stages, each stage may be revisited and revised as needed. As the project progresses, changes may need to be made as the dataset is tested and results are interpreted. The Agile method provides for that flexibility and will be appropriate for this project.

**B4. Timeline and Milestones**

A proposed timeline with milestones will be as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Project Milestones** | **Projected Start Date** | **Projected End Date** | **Duration** |
| Background & Research | 1/23/2023 | 1/31/2023 | 7 days |
| Dataset Wrangling | 2/1/2023 | 2/4/2023 | 3 days |
| Statistical Analyses | 2/6/2023 | 2/8/2023 | 3 days |
| Final Report Writing | 2/9/2023 | 2/12/2023 | 3 days |
| Editing and Corrections | 2/13/2023 | 2/17/2023 | 5 days |

**B5. Resources and Costs**

|  |  |
| --- | --- |
| **Personnel, Technology, or Infrastructure** | **Cost** |
| Dataset from Gun Violence Archive for Mass Shootings in 2022  *(https://gunviolencearchive.org/reports)* | NA |
| Gun Laws By State 2021  ([*https://giffords.org/lawcenter/resources/scorecard/*](https://giffords.org/lawcenter/resources/scorecard/)*)* | NA |
| Jupyter Notebook for Python Development Environment | NA |
| Data Analyst work hours | NA |

All data and information have been made available to the public at no cost. The python coding environment needed for this analysis has been downloaded and is available to the analyst. There are no additional costs or resources required for the completion of this project.

**B6. Criteria for Success**

Successful completion of this project will result in descriptive findings from dataset exploration and research findings based on applicable statistical analysis. Success will be determined by the results of the analytical findings regarding the objectives of this project by answering the following questions:

* Which states had the most mass shooting incidents in 2022?
* Which grades of state gun laws had the most and least number of mass shooting events?
* What is the probability of a mass shooting event occurring in each state grade?
* Do statistical differences occur between states with strict and weak gun laws and the number of mass shootings occurring in these states?

This project will be determined a success once the above questions are answered and any other insights are gathered and reported to add to the research base regarding this subject.

**Design of Data Analytics Solution**

**C1. Hypothesis**

There is no difference in the incidence of Mass Shooting Events between states with strict gun laws and states with weak gun laws.

**C2. Analytical Method**

Descriptive analyses will be used to determine trends and patterns within the data. Descriptive comparisons will be made among states and grading levels between states regarding gun laws and mass shooting events occurring in 2022.

Statistical analyses will determine if there is a statistically significant difference in the incidence of mass shooting events among state gun law groups from states with the strictest to weakest gun-control legislations. A One-Way Analysis Of Variance (ANOVA) will be used to determine if states, ranked from ‘A’ to ‘F’ via Giffords Law Center, result in higher or lower incidences of mass shootings.

**C2a. Justification of Analytical Method**

Descriptive analyses are a good way to identify current trends, relationships, and general information about a dataset. It will be conducive to gaining a better understanding of the relationship between state gun laws and mass shooting incidents in 2022.

A one-way ANOVA is a test to determine if there is a statistically significant difference among groups within one variable. This is appropriate for this project in analyzing if a statistically significant difference between state gun laws and the incidence of mass shootings exists. If ANOVA does determine statistical differences among the groups, additional post-hoc tests will be used to determine which groups are significant. Should this method be determined not the best fit for the dataset, other statistical methods may be utilized such as a two sample T-test. This project will follow the iterative Agile method in determining the best statistical analyses to be performed for this project.

**C3. Tools and Environments of Solution**

The environment that these analyses will use is Jupyter Notebook using Python and related libraries. Python is a robust programming language that is useful to clean, analyze, organize, and manipulate data while performing various statistical analyses and format tables for data viewing.

**C4. Methods and Metrics to Evaluate Statistical Significance**

Using ANOVA to determine statistical significance between state gun law groups, an F-Value and p-value will be obtained. The F-value will evaluate variance between and within the state gun law groups and determine the relationship between the groups and mass shooting events. The p-value will be compared to an alpha of 0.05 to determine if the ANOVA results are statistically significant. A p-value greater than the alpha suggests the Null Hypothesis is valid and there is no significant difference between the groups. A p-value less than the alpha suggests the Alternative Hypothesis is true and a statistical difference between the groups does exist.

**C4a. Justification Of Methods and Metrics**

This project will analyze if state gun laws have an impact on mass shooting events. To determine statistical significance between the state gun law groups, ANOVA is the best statistical method as it determines the difference in variance between groups as they relate to a continuous dependent variable. For this project, the continuous dependent variable will be the incidence of mass shootings occurring within each state in 2022.

**C5. Practical Significance**

Gun violence continues to plague Americans with new incidents occurring each day. Most individuals are polarized when it comes to solutions regarding decreasing gun violence. With each new mass shooting event, the debate regarding gun control and increasing state legislation is renewed. This project will add to the current research regarding the impact of gun control measures on gun violence.

**C6. Visual Communication**

Tables, graphs, and other visual content will be created to represent descriptive and statistical findings. Bar graphs may be used to depict the number of mass shootings by state grade, as well as histograms and trend lines to visualize the incidence of mass shootings over 2022.

**Description of Dataset(s)**

**D1. Source of Data**

The dataset used for this analysis comes from the Gun Violence Archive which keeps records of all gun-related violence by year and category. For this analysis, the dataset regarding mass shooting events in all states for the year 2022 will be utilized. This dataset will be compared to the Gifford Law Center State Scorecard for Gun Laws for the year 2021. The Gifford Law Center analyzes legislative measures that states implement each year regarding Gun Laws, and assign that state with a letter grade. The letter grades vary from ‘A’ to ‘F’, with ‘A’ indicating the states with the strongest gun laws and ‘F’ indicating states with the weakest gun laws.

**D2. Appropriateness of Dataset**

The Gun Violence Archive tracks and keeps record of all gun-related incidents in America. It is the most comprehensive and reliable source to be used for this project. As this project serves the purpose to add to the already existing research base concerning gun legislation and gun-related violence, using the most current dataset from 2022 is prudent. As it typically takes time to implement government legislation, analyzing a 2022 gun violence dataset to the state laws implemented in 2021 gives those states time to see if the legislative measures have an impact on gun violence for the state.

**D3. Data Collection Methods**

Data will be downloaded from the gun violence archive which is publicly available in a .csv file. Following download, the datafile will be uploaded to a Jupyter Notebook environment where Python will be used to further explore the dataset. Various Python tools will be utilized to determine the format, data types, and additional information regarding the dataset. Information regarding State Gun Law grades will be obtained directly from the Gifford’s Law Center website which has each state’s grading listed by year.

**D4. Data Quality**

The dataset utilized for this project lists the mass shooting events by date, state, city/county, address, and the number of people killed and injured for all incidents occurring in 2022. Additional details regarding specific information for each mass shooting event is included as a link to a separate resource. This data is made available to the public and has already removed any personal identifiable information. This project analysis will further remove the specific details regarding each mass shooting incident, as the primary focus of analyses will be the date, state, number of mass shooting incidents, and number of individuals killed or injured.

**D5. Data Governance, Privacy and Security, Ethical, Legal, and Regulatory Compliance**

Since this data is publicly available and all personal information is removed, the principles of data governance regarding privacy, ethical, legal, and regulatory compliance have already been considered and applied.

**D5a. Precautions**

My use of this dataset will be to perform my own individual project analysis for educational purposes. This dataset is already cleaned, maintained, secured, and complies with ethical and legal requirements for data management. All analyses I will perform will be on copies of the original dataset and maintained solely by me for the purpose of completing this project.

**E. SOURCES**

[Charbonneau](https://www.rand.org/about/people/c/charbonneau_amanda.html), A (2018, March). *Effects of Background Checks on Violent Crime.* Rand Corporation’s Gun Policy in America. <https://www.rand.org/research/gun-policy/analysis/background-checks/violent-crime.html>

Duchesne, J., Taghavi, S., Toraih, E., Simpson, J. T., & Tatum, D. (2022). State Gun Law Grades and Impact on Mass Shooting Event Incidence: An 8-Year Analysis. *Journal of the American College of Surgeons*, *234*(4), 645–651. <https://doi.org/10.1097/XCS.0000000000000118>

*Gun Violence Archive*. (n.d.). <https://www.gunviolencearchive.org/>

Jehan, F., Pandit, V., O'Keeffe, T., Azim, A., Jain, A., A Tai, S., Tang, A., Khan, M., Kulvatunyou, N., Gries, L., & Joseph, B. (2018, January). *The burden of firearm violence in the United States: Stricter laws result in safer states*. Journal of injury & violence research. Retrieved February 8, 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5801608/

Masters, J. (2022, June 10). *U.S. Gun Policy: Global Comparisons*. Council on Foreign Relations. https://www.cfr.org/backgrounder/us-gun-policy-global-comparisons

Merrefield, C. (2023, January 25). *Can universal background checks curb gun violence?* The Journalist’s Resource. https://journalistsresource.org/politics-and-government/background-checks-gun-violence-research/

*Policies That Reduce Gun Violence: Firearm Purchaser Licensing*. (2021, July 23). Johns Hopkins Bloomberg School of Public Health. https://publichealth.jhu.edu/2021/policies-that-reduce-gun-violence-firearm-purchaser-licensing

Webster, D. W., McCourt, A. D., Crifasi, C. K., Booty, M. D., & Stuart, E. A. (2020). Evidence concerning the regulation of firearms design, sale, and carrying on fatal mass shootings in the United States. *Criminology & Public Policy*, *19*(1), 171–212. https://doi.org/10.1111/1745-9133.12487