**Guns and Death.**

**Background and Motivation:**

Guns are an extremely polarized object in the United States. To some, they are seen as a fundamental right of self-defense and safeguard against tyranny. To others, they are seen as one of the great evils of the nation since they’re responsible for countless deaths. Indeed, the US is notorious for its gun violence crisis. From school shootings to police shootings and to high gun death in general, it is not surprising that the US’s unique 2nd Amendment, which guarantees its inhabitants the right to a firearm (2A for short), is heavily criticized. In the US, around 40K are killed annually by guns meaning around 100 daily firearm deaths. This has led to many calls for strengthening gun laws to even getting rid of the 2A. But not everyone agrees and there is huge debate on this. Would strengthening gun laws or banning the 2A actually save lives? Or would people just find other ways to kill each other and themselves? Perhaps, instead would more death occur as law abiding citizens would have less access to a means of self-defense to stop criminals? And is it worth breaching an essential right granted by the founding fathers to save lives instead possibly? This macro-statistical analysis of guns seeks to answer these questions.

**Datasets:**

3 major datasets were analyzed. The 1st consisted of gun trends between different US states, the 2nd consisted of gun trends across the developed world, and the 3rd consisted of gun trends throughout the world. The 3rd dataset was divided into 2 versions, one consisting of all the data, and the second where the outliers were removed. The variables analyzed were measures of gun frequency and strength of gun laws compared to murder and suicide rates. All values were calculated proportionally based on weightages which were assigned based on populations. The data for the datasets were obtained from various sources. A p value of 0.01 was used for tests in significance.

**US Dataset:**

The independent variables were gun ownership rates and number of gun laws. The dependent variables were murder and suicide rates. The weights were the populations for each state. The data were pulled from sources linked [1][2][3][4][5]. The null hypothesis was that gun ownership rates and number of guns laws have no effect on murder and suicide rates. Each combination was tested leading to the following 4 graphs:

Chart, scatter chart

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For the 1st graph, the R2 value was roughly 0.221, with a p value of 0.000471. For the 3rd graph, the R2 value was roughly 0.202 with a p value of 0.000892. This indicates that gun ownership rates and gun control laws are poor predictors of murder rates. However, the p values are significant, so we reject our null hypothesis that gun ownership and gun laws are not correlated with murder rates.

For the 2nd graph, the R2 value was roughly 0.638 with a p value of 6.24e-14. For the 4th graph, the R2 value was roughly 0.484 with a p value of 4.01e-09. This indicates that gun ownership rates and gun control laws are moderately good predictors of suicide rates. Moreover, the p values are significant, so we reject our null hypothesis that gun ownership and gun laws are not correlated with suicide rates.

An interesting observation was the notably larger spread for red datapoints for the murder graphs. Some of the most dangerous states in the country such as Mississippi and Louisiana have high gun ownership rates and lax gun regulation. Yet, some of the safest states in the country such as Maine and Vermont also have high gun ownership rates and low gun regulation.

**Developed Country Dataset:**

The countries chosen for this dataset were those with high human development indices. The US however, was omitted as it was an extreme outlier in both murder and gun prevalence rates which would have led to inaccurate results for correlations and p values. The independent variables were gun prevalence rates and gun law strictness and the independent were the murder and suicide rates with weights being the population. Gun law strictness was a discrete variable with 3 categories. A where gun laws were permissive, B where gun laws were restrictive, and C where gun laws prohibited guns. The data were pulled from the sources linked [6][7][8][9][10][11]. The null hypothesis was that gun prevalence and gun laws had no effect on murder and suicide rates. The following 2 graphs were obtained:

Chart, scatter chart

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For the 1st graph, the R2 value was roughly 0.403, with a p value of 5.45e-05. This indicates that gun prevalence rates are moderately good predictors of murder rates. Moreover, the p value is significant, so we reject our null hypothesis that gun ownership and gun laws are not correlated with suicide rates.

For the 2nd graph, the R2 value was roughly 0.0650 with a p value of 0.160. This indicates that gun prevalence rates are poor predictors of suicide rates. Moreover, the p value is not significant, so we fail to reject our null hypothesis that gun ownership and gun laws are not correlated with murder rates.

The restrictive gun control category had the highest murder rate followed by the permissive and finally the prohibited. The p-value between restrictive and permissive gun laws was 8.15e-06, so we reject the null hypothesis. The p-value between prohibited and permissive gun laws was 0.0823, so we fail to reject the null hypothesis. The p-value between restrictive and prohibited gun laws was 4.18e-06, so we reject the null hypothesis.

The prohibited gun control category had the highest suicide rate followed by the permissive and finally the restrictive. The p value between the prohibited and permissive gun laws was 0.108, the p value between permissive and restrictive 0.0246 and the p value between prohibited and restrictive was 0.0195. Thus, in all cases, we fail to reject the null hypothesis that gun laws do not influence suicide rates.

**World Dataset:**

A set of 171 countries (the countries where data for each category of interest could be found) around the globe were recorded for this dataset. Two versions of this dataset were analyzed. The first version consisted of each of the countries, and the second version had outliers removed (for prevalence, murder, and suicide rates). The same independent and dependent variables were used as the developed world dataset. An additional analysis was made by dividing the data into the countries with higher murder/suicide rates than the US, and countries with lower murder/suicide rates than the US, and testing for a significance difference of gun prevalence. The data were pulled from sources linked [6][7][8][9][10][11]. The null hypothesis was that gun prevalence and gun laws had no effect on murder and suicide rates, and that gun prevalence rates were not different between countries with higher murder/suicide rates than the US, and countries with lower rates. The following 4 graphs were obtained:

Chart

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Chart, scatter chart

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For the 1st graph, the R2 value was roughly 0.00248, with a p value of 0.518. For the 3rd graph, the R2 value was roughly 0.0114 with a p value of 0.188. This indicates that gun ownership rates are poor predictors of murder rates regardless of outlier influence. Moreover, the p values are insignificant, so we fail to reject our null hypothesis that gun prevalence is not correlated with murder rates.

For the 2nd graph, the R2 value was roughly 0.0956 with a p value of 3.45e-05. For the 4th graph, the R2 value was roughly 0.0224 with a p value of 0.0639. This indicates that gun prevalence rates are poor predictors of suicide rates regardless of outlier influence. However, the p value is significant in the outlier case, so we reject our null hypothesis that gun prevalence is not correlated with suicide rates. We do not reject the null hypothesis for the non-outlier case. In all cases, gun prevalence is a poor predictor in murder and suicide rates.

For the whole set, the restrictive gun control category had the highest murder rate followed by the permissive and finally the prohibited. The p-value between restrictive and permissive gun laws was 0.0994, so we fail to reject the null hypothesis. The p-value between permissive and prohibited gun laws was 0.0233, so we fail to reject the null hypothesis. The p-value between restrictive and prohibited gun laws was 0.000626, so we reject the null hypothesis that prohibited and restrictive gun laws do not influence murder rates.

For the whole set, the permissive gun control category had the highest suicide rate followed by the restrictive and finally the prohibited. The p value between the permissive and restrictive gun laws was 0.0226, the p value between restrictive and prohibited is 0.000459 and the p value between prohibited and permissive was 0.000218. Thus, in the latter two cases, we reject the null hypothesis that gun laws don’t affect suicide rates.

For the trimmed set, the permissive category had the highest murder rate followed by the restrictive and finally the prohibited. The p value between the permissive and the restrictive was 0.773, the p value between the restrictive and prohibited was 0.000196, and the p value between the permissive and prohibited was 0.0260. Thus, in the second case, we reject the null hypothesis that gun laws don’t affect murder rates.

For the trimmed set, the restrictive category had the highest suicide rate followed by the probhited followed by the permissive. The p value between the restrictive and prohibited is 0.00157, the p value between the prohibited and permissive is 0.839, and the p value between the restrictive and permissive is 0.0577. Thus, in the first case, we reject the null hypothesis that gun laws don’t affect murder rates.

For the whole set, there was higher gun prevalence in countries with more murder than the US. However, the p value was 0.292, so the difference was not statistically significant.

For the whole set, there was higher gun prevalence in countries with more suicide than the US. Moreover, the p value was 0.00989, so the difference was statistically significant.

For the trimmed set, there was higher gun prevalence in countries with more murder than the US. However, the p value was 0.955, so the difference was not statistically significant.

For the trimmed set, there was higher gun prevalence in countries with more suicide than the US. However, the p value was 0.0340, so the difference was not statistically significant.

**Analysis:**

This section will focus on answering the questions raised in the motivation section based on the data and relationships obtained.

Namely:

1. Would strengthening gun laws or banning the 2A actually save lives?
2. Or would people just find other ways to kill each other and themselves?
3. Perhaps, instead would more death occur as law abiding citizens would have less access to a means of self-defense to stop criminals?
4. And is it worth breaching an essential right granted by the founding fathers to save lives instead possibly?

The answer to the first question seems to be that stronger gun laws/less gun prevalence are related to lower murder/suicide rates. There is some evidence in the data that challenges this, but much of the continuous data in the scatter plots points to it. Looking in the US, all the correlations point to more gun laws/less gun prevalence leading to less death. In addition, all the correlations are statistically significant. Looking in the developed world, there is a positive, statistically significant correlation for gun prevalence and murder. While the suicide correlation is negative, it is not statistically significant. Furthermore, there are positive correlations in all the world data graphs and, whilst comparing against the US, in each case, higher death averages were linked to the higher gun prevalence averages.

Despite good evidence for a yes to the first question, much of this same evidence and additional evidence points to people largely finding ways to kill each other and themselves despite more gun laws/less gun prevalence. While there is an abundance of evidence in the continuous data that points to less guns/stronger gun laws leading to less death, this same evidence largely also shows that less guns/stronger gun laws do not lower deaths significantly as much of the correlations are rather weak and/or statistically insignificant. Much of the discrete data were also rather mixed. To start, like the continuous data, there was some evidence pointing to looser gun regulation pointing to more death. For instance, in the murders category of the trimmed world set, permissive category had the most murder, followed by the restrictive, and finally the prohibited. There was also a statistical significance between restrictive and prohibited categories. However, there is also evidence that weaker gun laws actually are related to lower death. For example, there were several instances where a category with lower strength would have less death and sometimes, the differences would additionally be statistically significant. Finally, much of the orderings between the gun control categories were different from each test and much of the p values were not significant. In summary, more guns/less gun laws are somewhat related to lower death rates, but not significantly so. The continuous data largely point to gun laws/less guns somewhat saving lives, and the discrete data are rather mixed.

Other than some mixed evidence in the discrete data, there is almost no evidence to back the claim that less guns implies more death.

The last question is impossible to give an objective answer for as it is one of highly subjective nature and depends largely on an individual’s values. On the extremes, there are some who believe that even preventing one gun suicide is a valid enough reason to ban a constitutional right, while, on the other end, there are some who would say that this right deserves absolute protection no matter how many lives may be saved from additional gun control. However, this report can largely help an individual who already has not made up their mind to decide whether stronger gun laws are worth it and use numeral evidence to back their points.

In summary, less guns/more gun control is somewhat related to less death. However, the reduction is not a particularly impressive one. There is not much evidence to conclude that more guns/less gun control would actually save lives. Like most things, the truth about the gun debate seems to be somewhere in the middle.

**Possible Inaccuracies/Limitations:**

The major limitation to this analysis is it was limited to correlation and not causation.

Pearson correlation and their respective p-value calculations rely on normality on the data and low outlier prevalence. Many of the data are likely not entirely normal, and some had outliers. Calculating p values from T-tests also needs these same assumptions. Because of this, a very low significance threshold of 0.01 was used to determine significance.

For the US data, the gun ownership rates were estimates made from data collected as of 2021, the number of gun laws was as of 2018, the murder and suicide rates were based on 2019 data, and the populations were based on 2021 data. There is not much reason to think that overall gun prevalence, gun laws, murder, and suicide rates changed much in these time periods, so it should not have led to much error. US territories/regions such as Washington DC, Puerto Rico, etc were not recorded as all their data could not be obtained. These places have relatively small populations, so this should not have affected the data in any significant way.

The US data are likely not normal, but there weren’t outliers. The calculated values likely give good insight.

For the developed country analysis, the US was omitted for being an outlier in murder and gun prevalence to prevent inaccurate numbers. It is difficult to say the relationships could be extrapolated for the United States, but based on the Human Development Indices, they do form a similar population to the US.

Just like the US dataset, the data are likely not normal and some of the data were collected in different years. There is also not much reason to think this would lead to much error.

As in previous datasets, the data in the world dataset are likely not normal and some of the data were collected in different years. Some countries for which all the data could not be found were omitted. These countries had relatively small populations, so should not have affected the data in any meaningful way.

**Sources:**

1. Gun Ownership Rates: https://worldpopulationreview.com/state-rankings/gun-ownership-by-state
2. Number of Gun Laws: https://www.cnbc.com/2018/02/27/states-with-strict-gun-laws-have-fewer-firearms-deaths-heres-how-your-state-stacks-up.html
3. Murder Rates US:

<https://www.cdc.gov/nchs/pressroom/sosmap/homicide_mortality/homicide.htm>

1. Suicide Rates US:

<https://www.cdc.gov/nchs/pressroom/sosmap/suicide-mortality/suicide.htm>

1. State Populations: <https://worldpopulationreview.com/states>
2. HDI: <http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf>
3. Gun Prevalence: <https://worldpopulationreview.com/country-rankings/gun-ownership-by-country>
4. Gun Laws: https://www.gunpolicy.org/
5. Murder Rates World: <https://worldpopulationreview.com/country-rankings/murder-rate-by-country>
6. Suicide Rates World: <https://worldpopulationreview.com/country-rankings/suicide-rate-by-country>
7. Country Populations: <https://www.worldometers.info/world-population/population-by-country/>