



BROWN

Housing Price and Population Density Effects on Gun Violence

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Introduction

- **Hypothesis:** There is a statistical difference between gun violence rate (number of gun violence incidents per capita) between areas with expensive housing and areas with inexpensive housing. Specifically, we expect areas with expensive housing to have lower rates of gun violence and vice versa for areas with less expensive housing. We also hypothesize gun violence rate will increase with population density.
- **Note:** we found that population has a lot to do with the rates of gun violence, specifically, areas with population less than 50,000 and greater than 500,000 have a large variability in gun violence rates, so we chose to focus our examination in the 50,000 - 500,000 population range. Additionally, housing prices tend to work better as a metric of socioeconomic status for cities with similar populations, since an equivalent standard of living often becomes more expensive for bigger cities.

Data

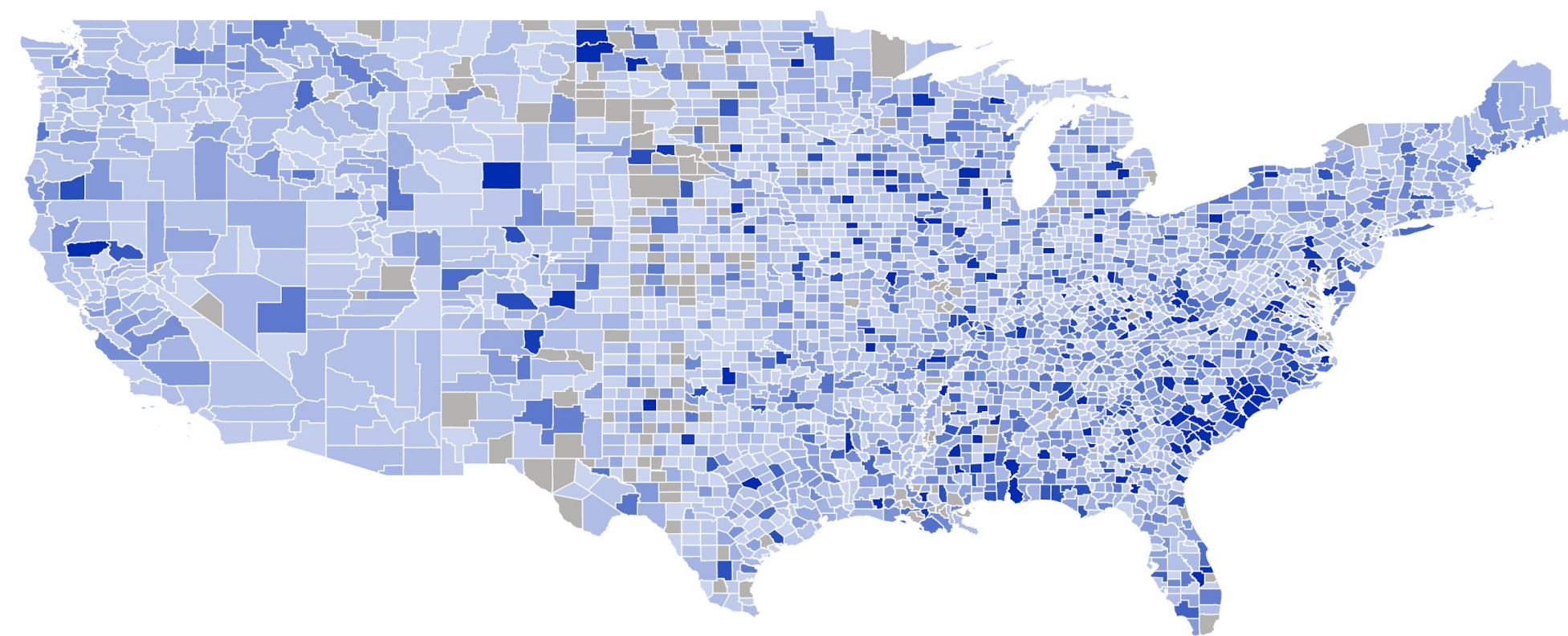
We obtained our data from **3 sources**:

1. 263,653 gun violence incidents data from 2014-2018 end of March from the GunViolenceArchive: <https://www.gunviolencearchive.org/>
2. 27,554 towns/cities with up to 260 price estimates, ranging from 1996 to 2013 Housing Prices by state from the Zillow housing data by regions in csv format from <https://www.zillow.com/research/data/>
3. 40,840 incidences of population data broken by counties and cities from the US census in csv format from <https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>

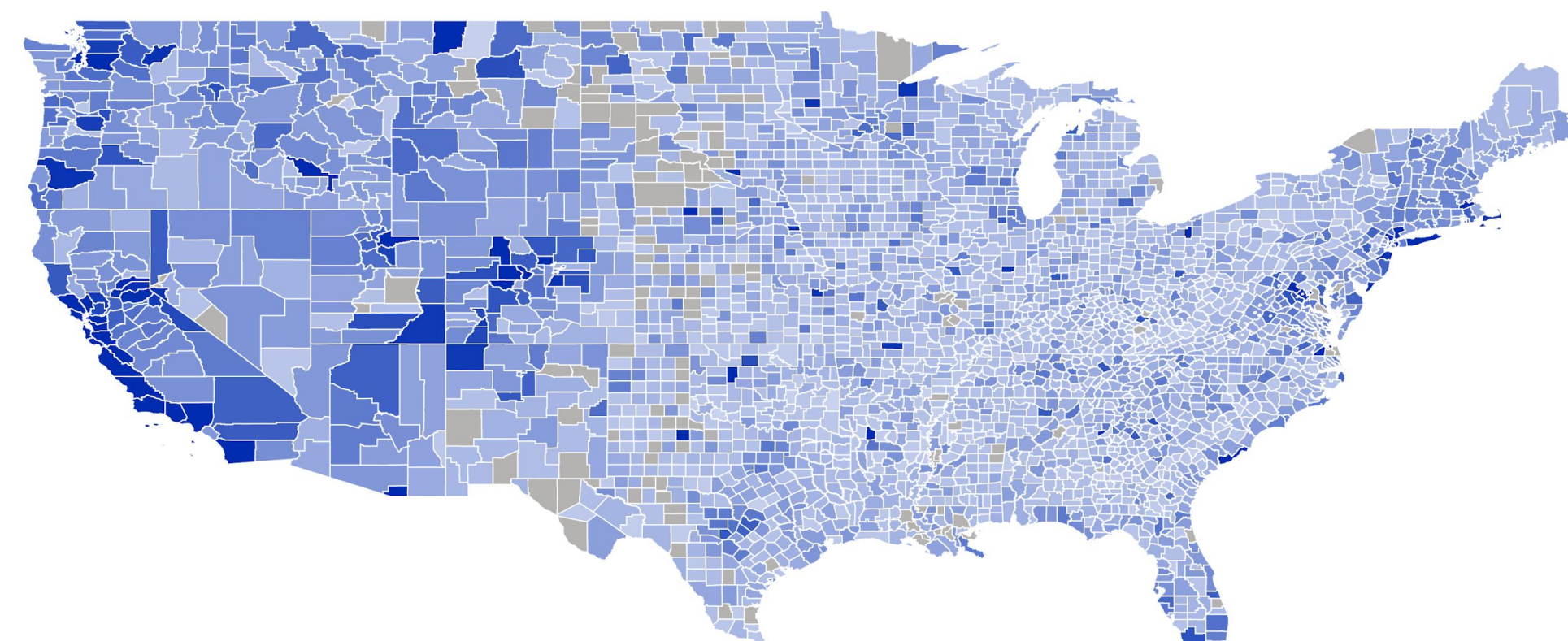
We found that the Gun Violence Database contained ~5% rows that do not provide location data. The other two sources of data were relatively clean and had little to no missing or duplicated data, except for some missing price estimates in the Zillow Database since it contains data all the way back to 1996.

US Map

Gun Violence Rate (Num Incidents per 1000 people per Year)



Housing Price (USD)



Linear Regression

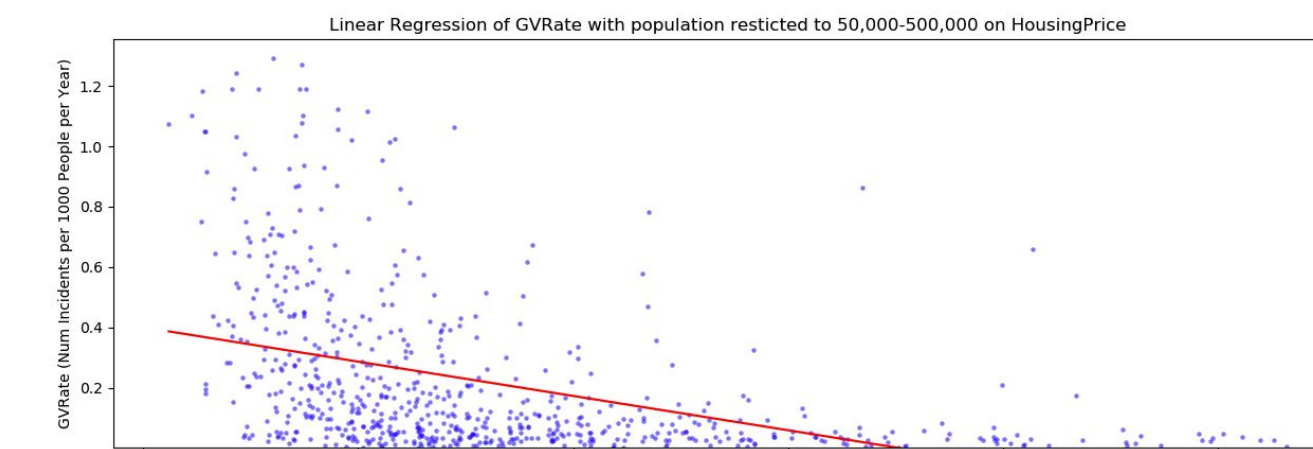


Figure 1. Linear Regression of Housing Price vs GVRate
Coefficient: $-5.69e-4$ (Incidents per 1000 people per Year per \$1000 House Value)

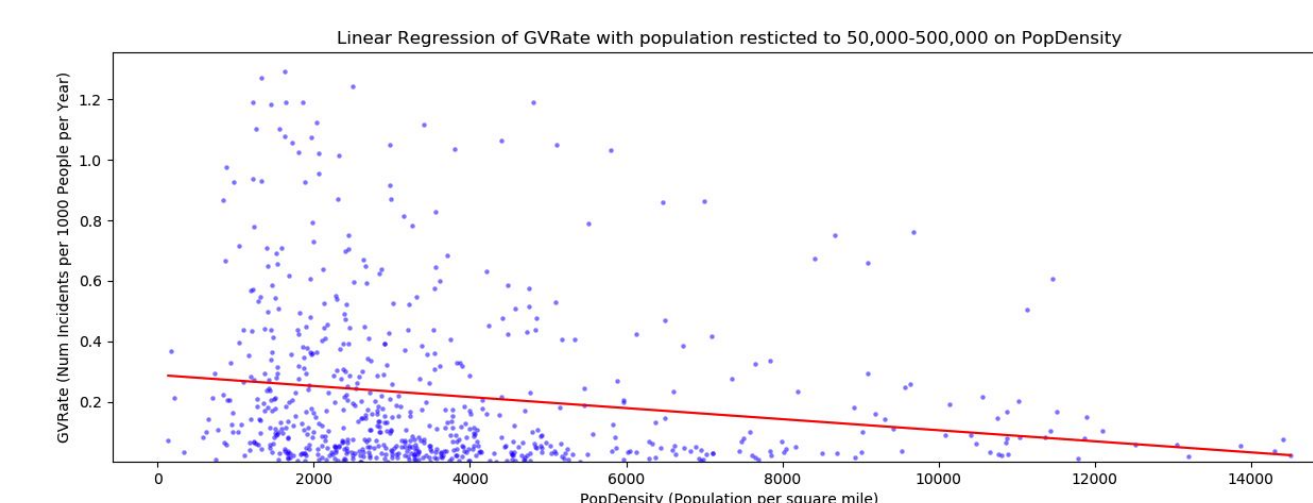


Figure 2. Linear Regression of Population Density vs GVRate
Coefficient: $-1.83e-3$ (Incidents per 1000 people per Year per 100 people per sq mi)

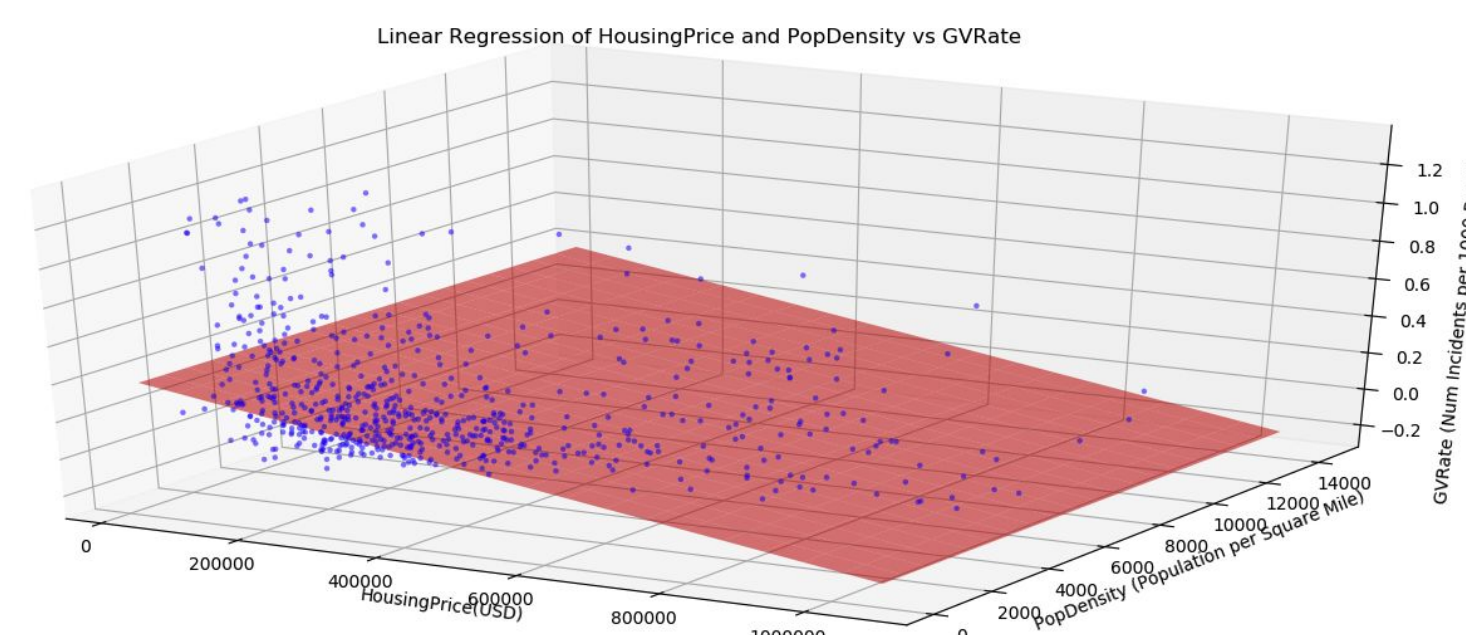
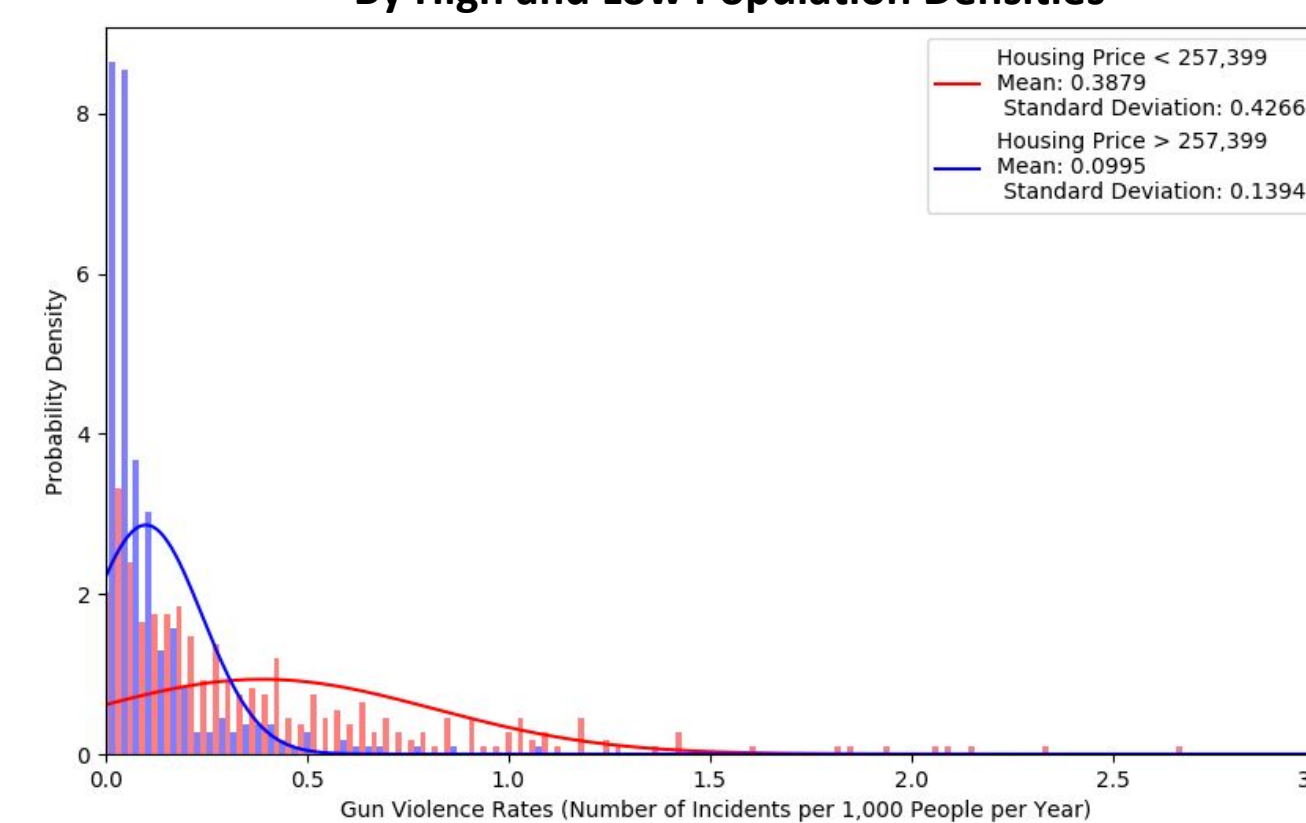


Figure 3. Linear Regression of Housing Price and Population Density vs GVRate
Coefficients (Housing Price: $-5.69e-4$ Incidents per 1000 people per Year per \$1000)
(Population Density: $-6.731e-5$ Incidents per 1000 people per Year per 100 people per sq mi)

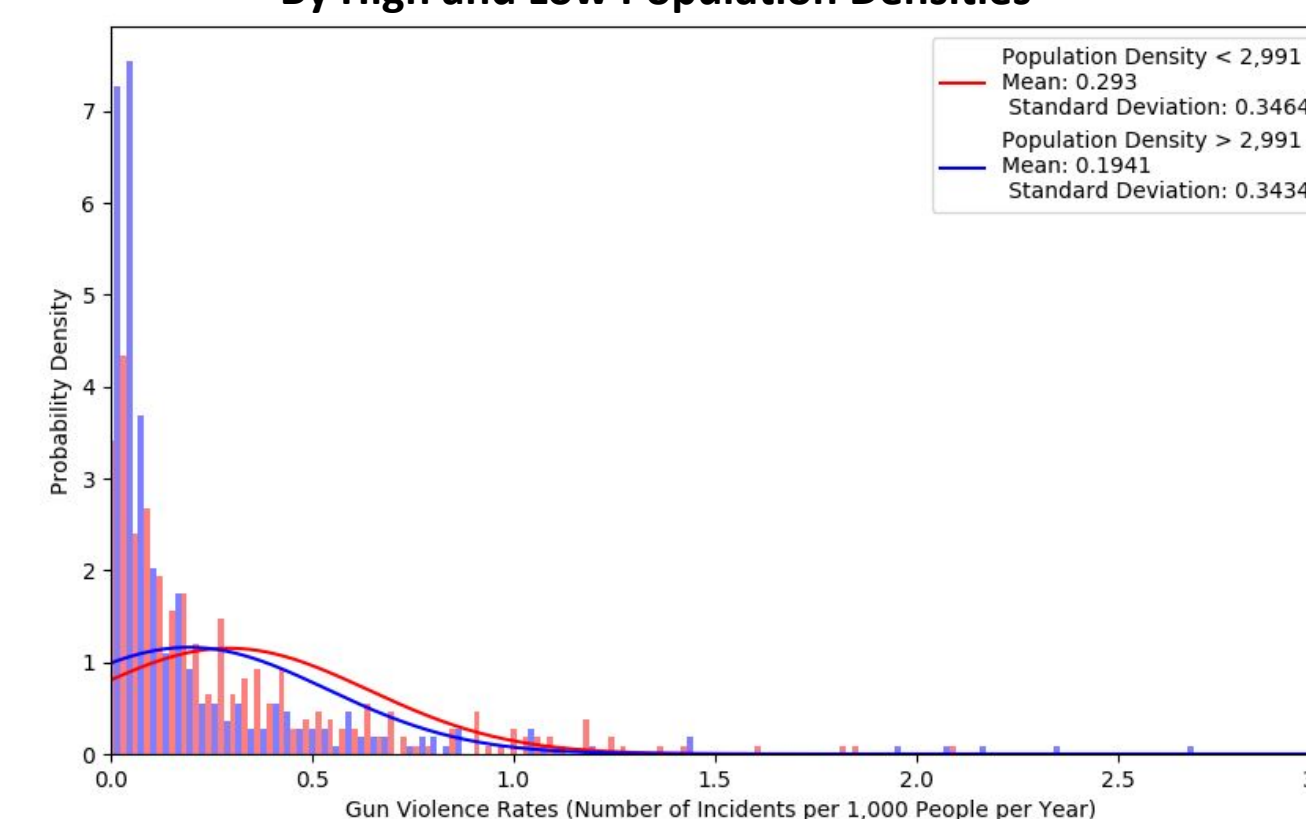
One Tailed T-Test

Housing Price vs Gun Violence (Population 50,000 - 500,000)
By High and Low Population Densities



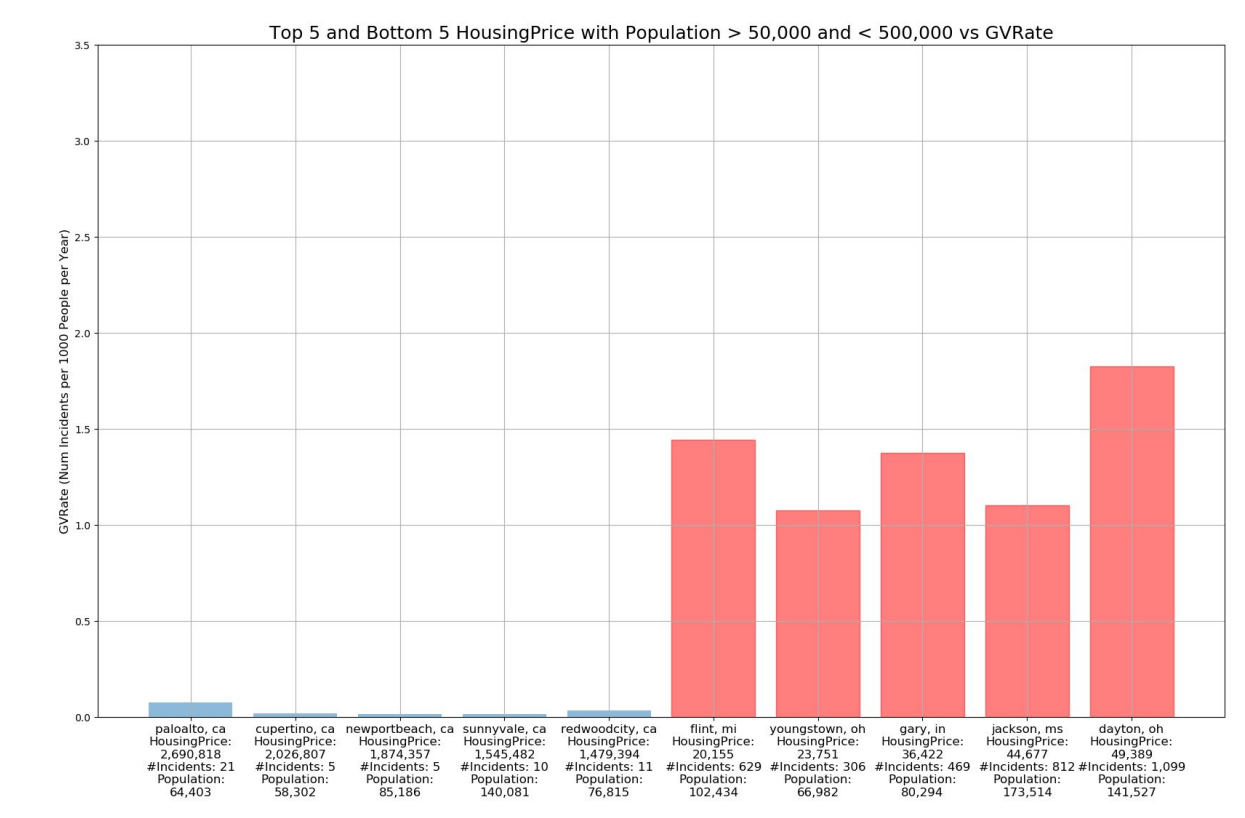
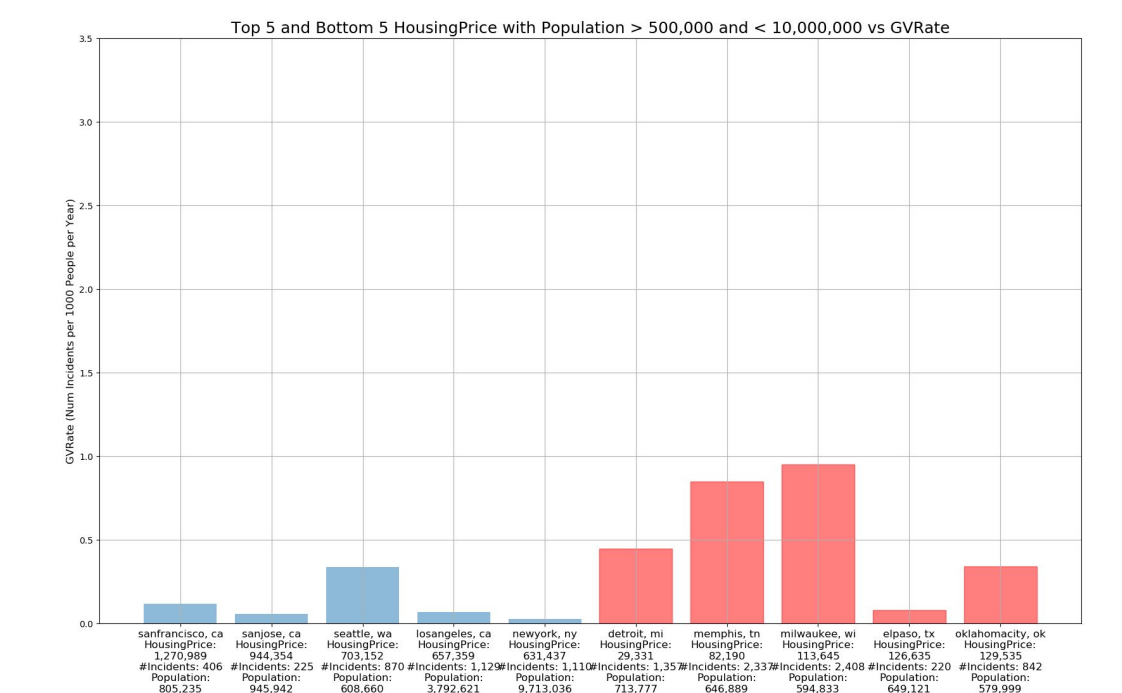
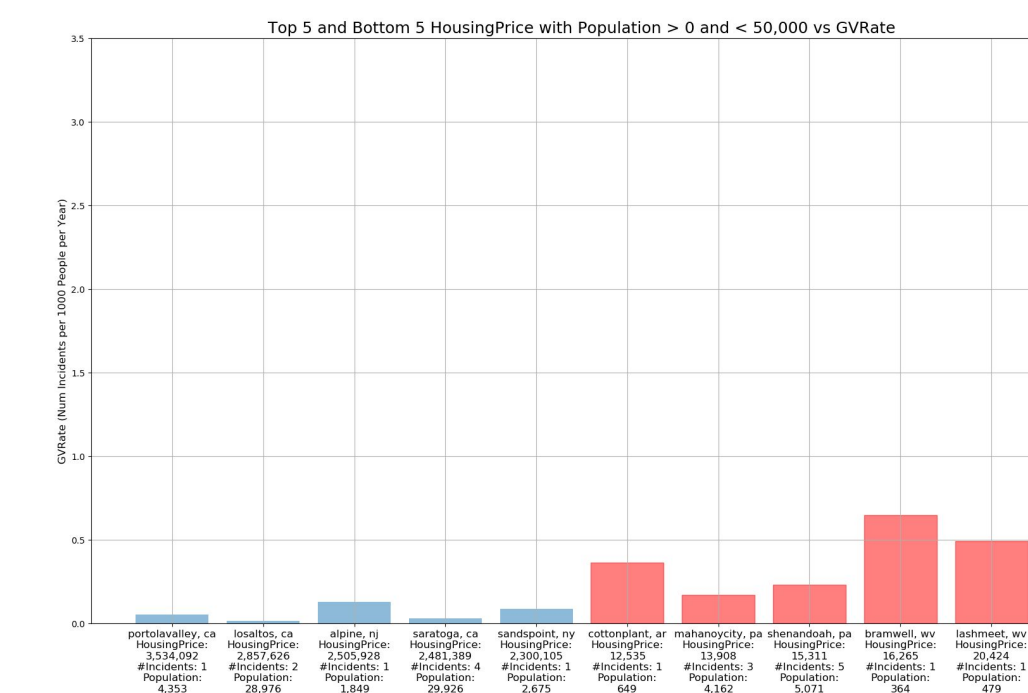
- Median Housing Price: \$257,399
- T: 11.81
- P-Value: $2.48e-28$ ($\alpha = 0.05$)

Pop Density vs Gun Violence (Population 50,000 - 500,000)
By High and Low Population Densities



- Median Population Density: 2991 people / sq mi
- T: 3.97
- P-Value: 0.99996 ($\alpha = 0.05$)

Bar Graphs



- The blue bar graphs show the top 5 highest housing prices in the given population range and the red shows the bottom 5 lowest housing prices in the given population range.

Discussion of Results/Future Work

- **Linear Regression:** There is a negative correlation for both Housing Price vs Gun Violence Rate and Population Density vs Gun Violence Rate.
- **One Tailed T-Test:** Since our p-value for Housing Price vs Gun Violence Rate is $2.47e-28$ and less than our significance level of 0.05 we can reject the null hypothesis that cities with more expensive housing have higher or similar rates of gun violence to cities with less expensive housing. However, since our p-value for Population Density vs Gun Violence Rate is 0.99996, we fail to reject the null hypothesis that higher population density results in higher rates of gun violence at a significance level of 0.05.
- **Bar Graphs:** We can see that from the range of 50,000 - 500,000 people that there is a clear separation between Gun Violence Rate from areas with high housing prices vs low housing prices. This distinction becomes less clear when we look at cities with less than 50,000 and higher than 500,000.
- **Map:** We broke the data down to county levels and color-coded the US map with rates of gun violence and housing prices by county.
- **Conclusion:**
 - In cities with populations of 50,000 - 500,000, there are higher rates of gun violence in areas with lower housing prices than areas with higher housing prices.
 - In cities with populations of 50,000 - 500,000, there are higher rates of gun violence in areas with lower population density than areas with higher population density.
- **Future Work:**
 - Examine the variability in gun violence rates in ranges below 50,000 and above 500,000 to see what other variable might be contributing to changes in gun violence rate.
 - Exploration of other variables that correlate with gun violence rate (i.e. economical indicators, ethnicity populations, average age of gun licenses, civic engagement).
 - We noticed that when we just looked at large cities, the gun violence rates actually had a positive correlation with population density which was different from the overall negative correlation. It would be interesting to further explore how the relationship between these variables changes depending on the types of cities we look at.