Gun Policy Effectiveness Predictor

Exploratory Data Analysis

CDC Dataset

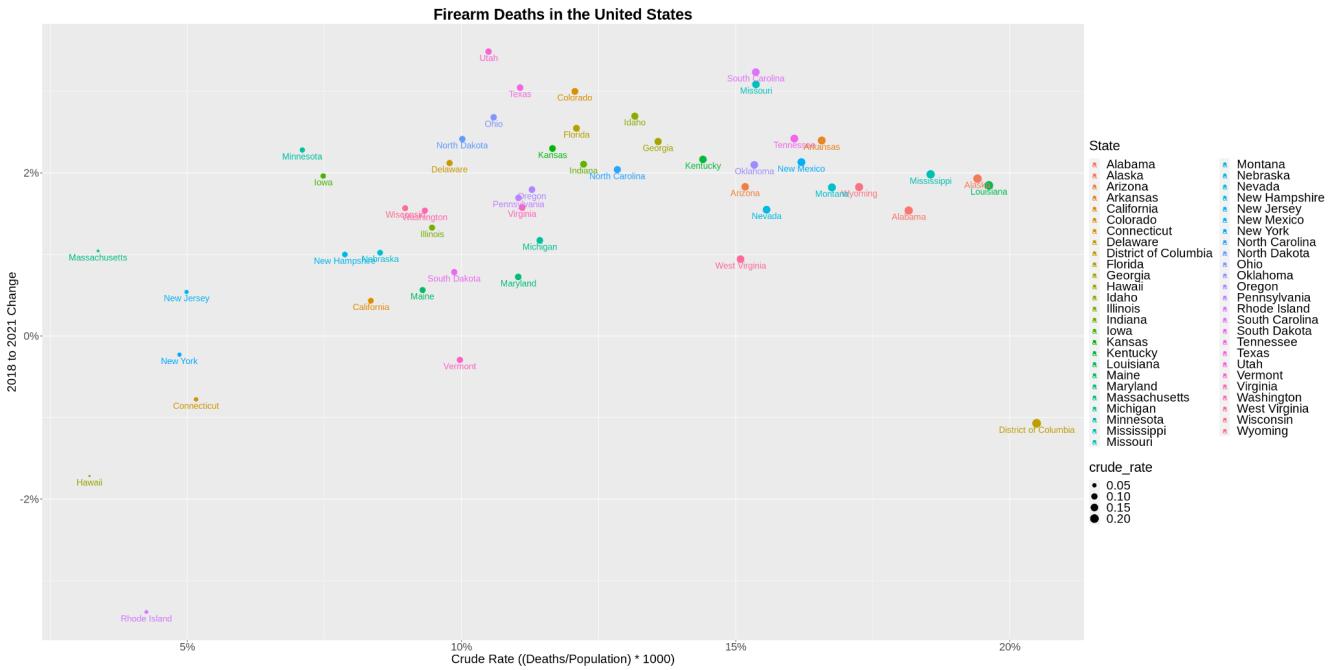
CDC = Centers for Disease Control and Prevention

Crude Rate vs. Change Rate

X-axis: Crude rate (Gun deaths per 1000 ppl)
Y-axis: Change in crude rate from 2018 to 2021

Takeaways:

- This plot is extremely useful, since it demonstrates both the current state (Crude rate as of 2021) as well as the trend over the past years (2018 to 2021 change)
- We could split the plot into 4 parts:
    - High change, low crude rate
        - Examples: Minnesota, Iowa, Delaware, Massachusetts
    - High change, high crude rate
        - Examples: South Carolina, Missouri, Tennessee, Kansas
    - Low change, low crude rate
        - Examples: Connecticut, Hawaii, Rhode Island, Vermont
    - Low change, high crude rate
        - Examples: District of Columbia

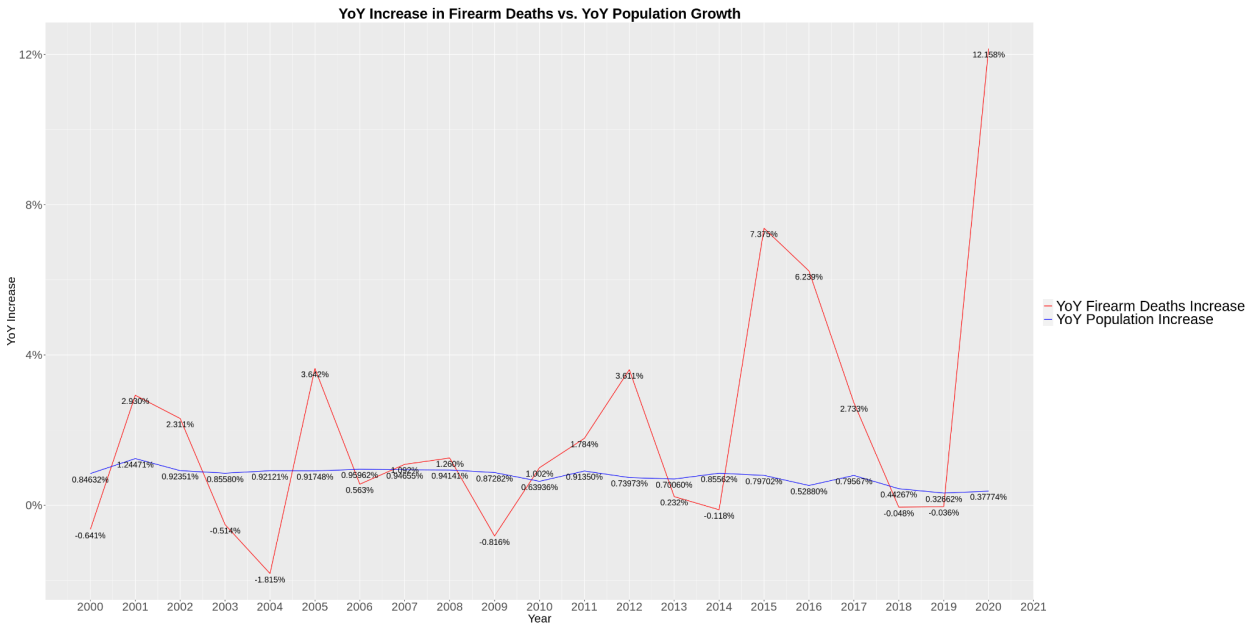


Firearm Deaths vs. Population Growth

X-axis: Year
Y-axis: Year-over-year change in metric

Takeaways:

- This plot demonstrates to discrepancy between the total US population yearly increase and the gun deaths yearly increase
- We can see there was an extremely big jump in gun deaths during 2019-2021

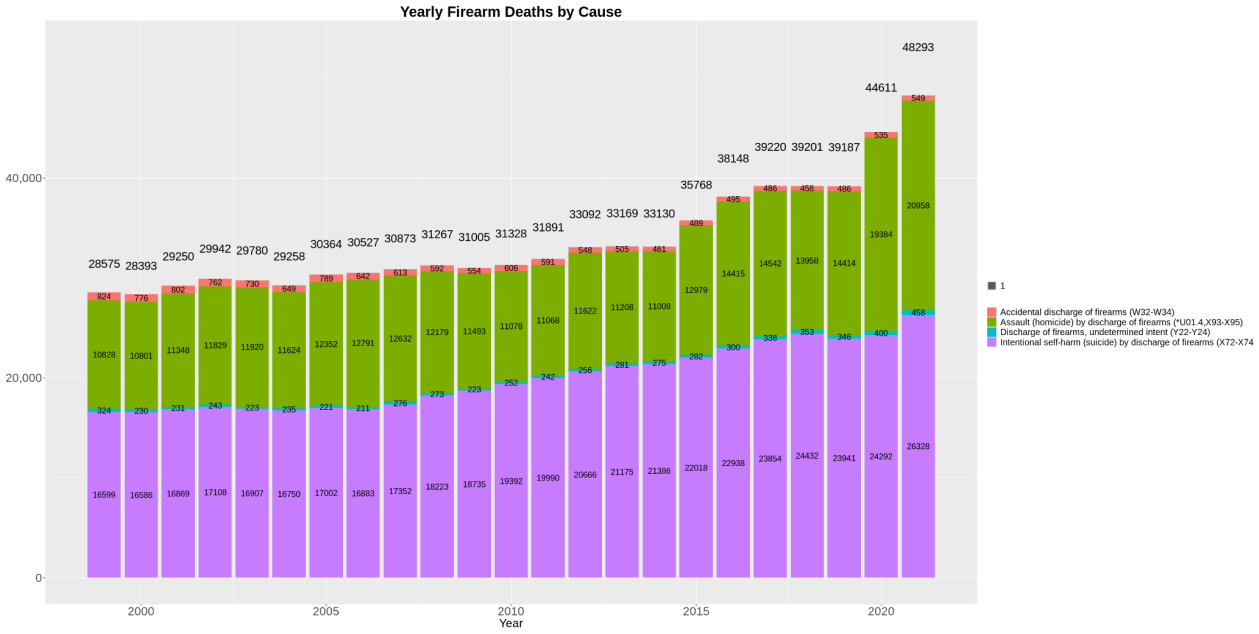


Yearly Firearm Deaths by Cause of Death

X-axis: Year
Y-axis: Gun deaths count

Takeaways:

- The overall trend is clear- gun deaths have been increasing over the past 20 years
- The #1 cause of death by firearms is suicide, with homicide being #2
- The number of deaths from accidents is relatively small, compared to the two reasons above



RAND Corporation Dataset

RAND = Research and Development (Nonprofit)

Restrictive vs. Permissive Gun Laws Wordcloud

Takeaways:

- Words that stand out in restrictive laws: firearm, licensed, transferee
- Words that stand out in permissive laws: force, concealed,carry

Restrictive:

Permissive:

ICPSR Dataset

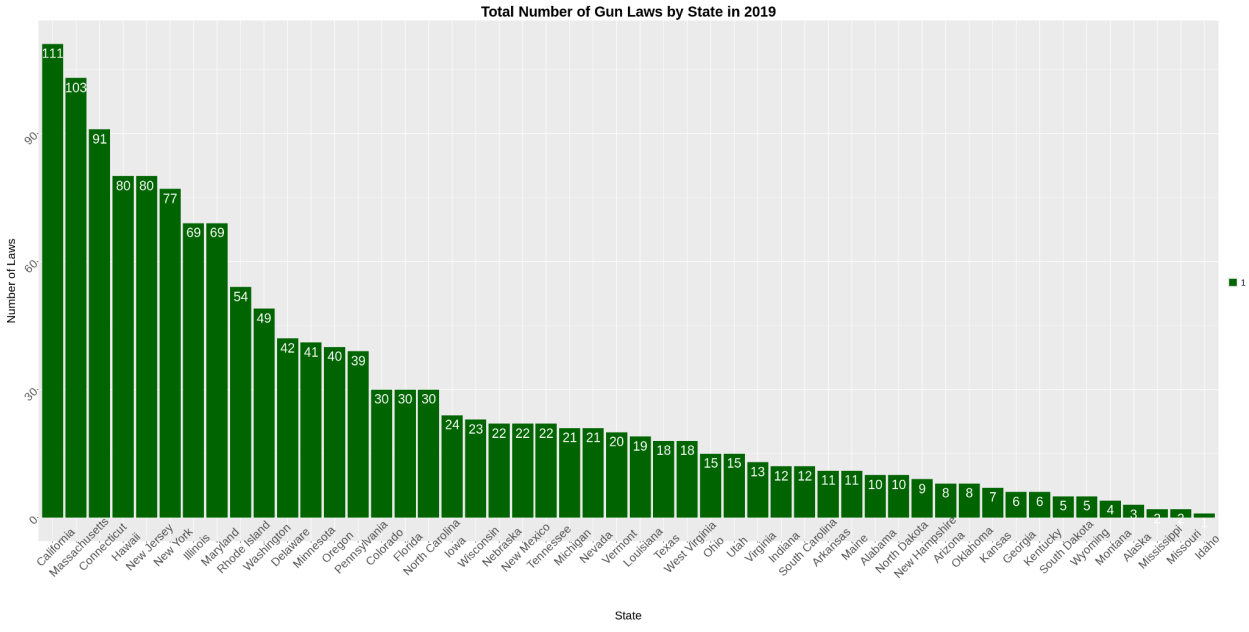
ICPSR = Inter-university Consortium for Political and Social Research

Total Existing Gun Laws per State

X-axis: State
Y-axis: Total number of existing gun laws (as of 2019)

Takeaways:

- California is the state with the most gun laws, and Idaho is the one with the least rules
- If we go back to the first plot in this doc (Crude Rate vs. Change Rate), we can clearly see a clear negative correlation between the number of total gun laws and the crude and change rates when it comes to gun deaths

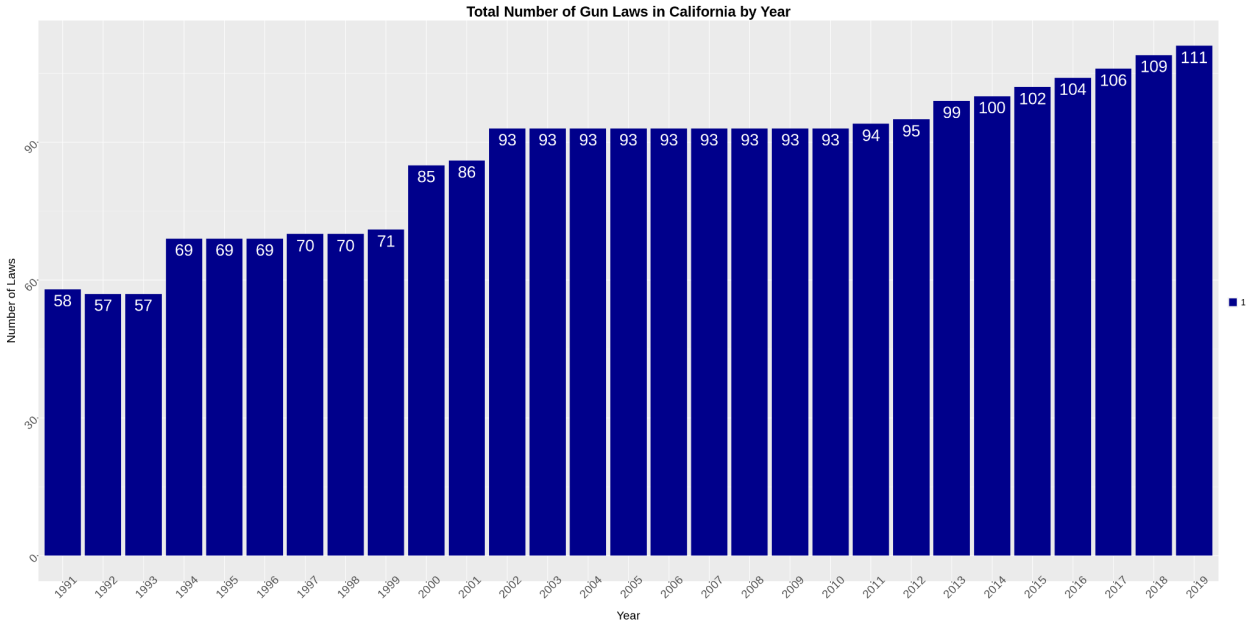


Total Number of Gun Laws in California by Year

X-axis: Year
Y-axis: Total number of existing gun laws in California

Takeaways:

- This plot demonstrate the growth trend in gun laws year-over-year, for California, which is the state with the most gun laws, as of 2019
- We can see that over the past 30 years, the number of gun laws almost doubled



ATF Dataset

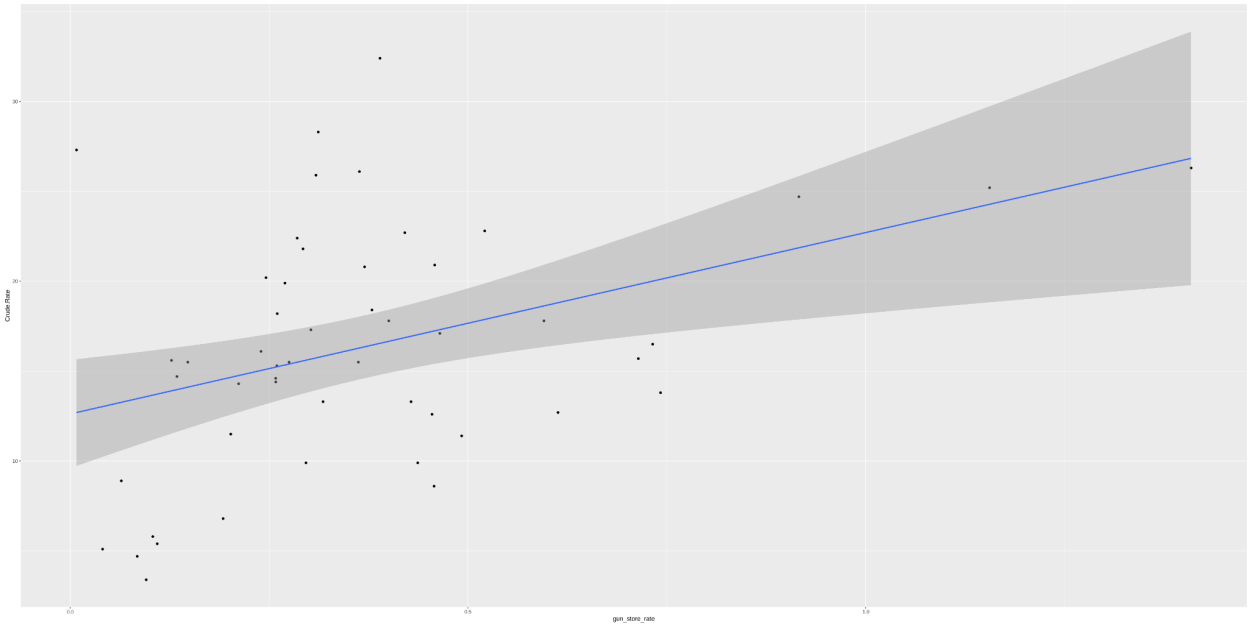
ATF = Bureau of Alcohol, Tobacco, Firearms and Explosives

Crude Rate vs. Gun Store Rate

X-axis: Crude rate (Gun deaths per 1000 ppl)
Y-axis: Gun stores rate (Gun stores per 1000 ppl)

Takeaways:

- Overall we can see a positive correlation between crude rate and gun stores rate
- In other words: The more gun stores there are per state residents, the high the gun death rates is
- There are several outliers, but the overall trend is positive



- If we examine the linear model below, we can see that every 0.01% absolute increase in gun stores per 1000 ppl increases the crude rate by 0.013%, on average

```
Call:
lm(formula = Crude.Rate ~ gun_store_rate, data = big_table)

Residuals:
     Min       1Q   Median       3Q      Max
-10.1831  -4.4877  -0.2075   3.3060  15.8517

Coefficients:
               Estimate Std. Error t value        Pr(>|t|)
(Intercept)      12.620      1.498   8.425 0.0000000000432 ***
gun_store_rate   10.089      3.278   3.078         0.00341 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 6.207 on 49 degrees of freedom
Multiple R-squared:  0.162,     Adjusted R-squared:  0.1449
F-statistic: 9.472 on 1 and 49 DF,  p-value: 0.003411
```

KFF Dataset

KFF= The Kaiser Family Foundation (Nonprofit)

Crude Rate vs. State Demographics Correlation Plot

Glossary:

Total Residents = Total state residents

Size = Total state size (square mileage)

Children.0.18 = Children under the age of 18 rate

Adults.19.25 = Adults ages 19-25 rate

X65. = Adults over age 65 rate

Male = Males rate

Female = Females rate

White = White race rates

Black = Black race rates

Hispanic = Hispanic race rates

Median.Annual.Household.Income = Median annual household income

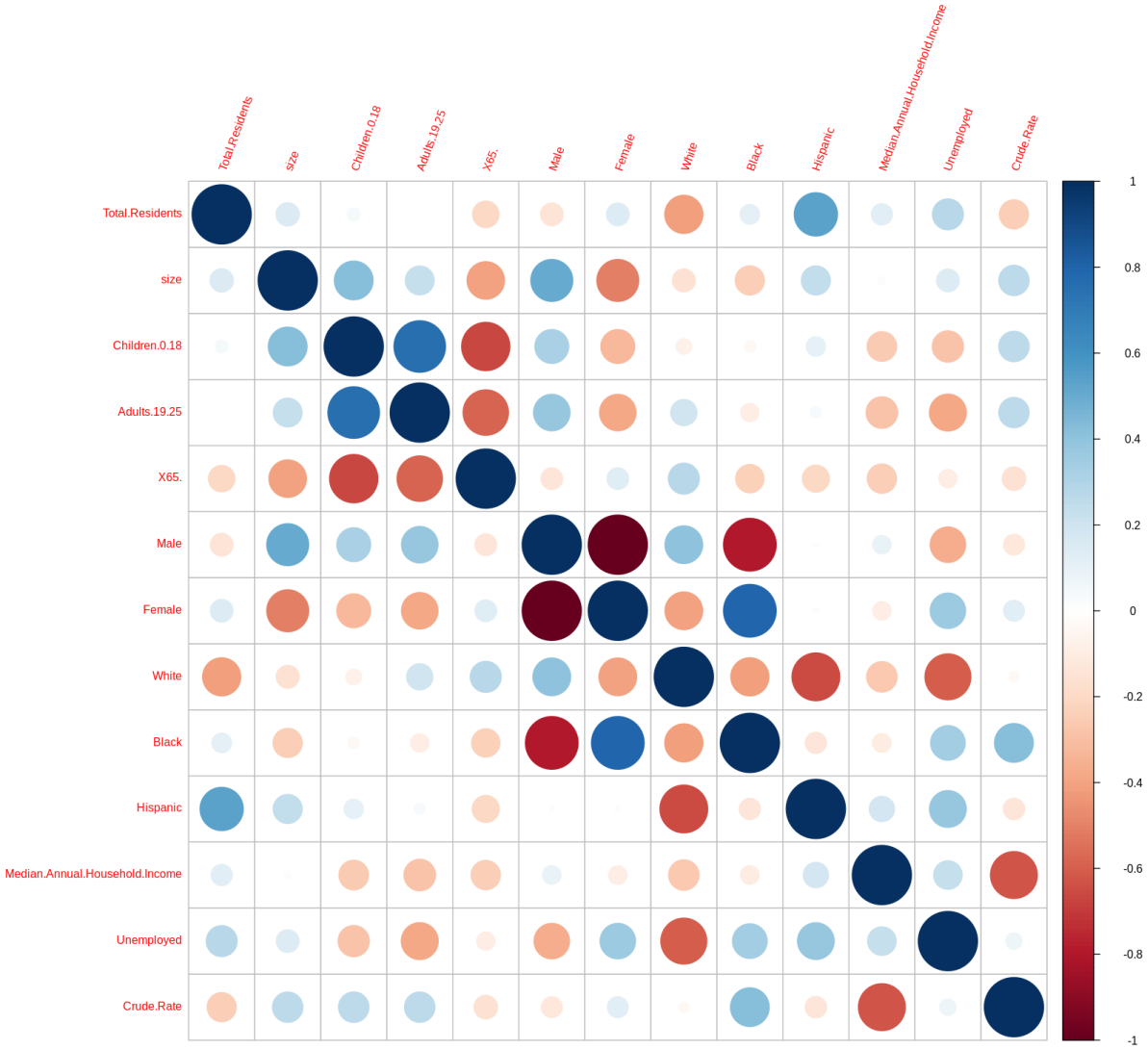
Unemployed = Unemployment Rate

Crude Rate =Gun deaths per 1000 ppl

Takeaways:

- Strong positive correlations:
    - State size and children/young adults rate
    - State size and male rate
    - State size and Hispanic residents rate
    - Female rate and black residents rate
    - Black residents rate and crude rate

- Strong negative correlations:
  - Size and ages 65+ rate
  - Median annual household income and crude rate
  - White residents rate and unemployment
  - Female residents rate and state size
  - Black residents rate and males rate

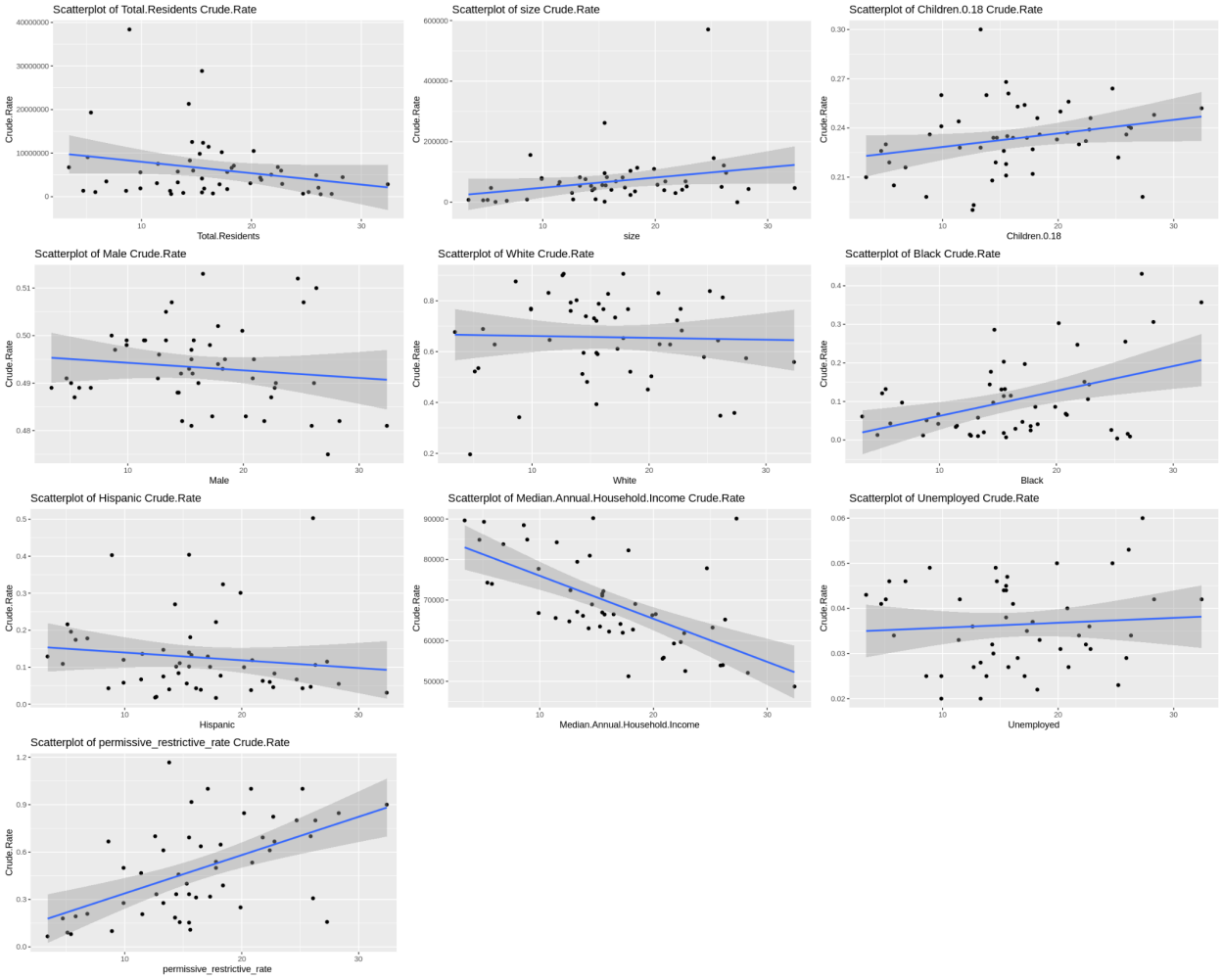


Crude Rate vs. State Demographics Scatter Plots

X-axis: Crude rate (Gun deaths per 1000 ppl)
Y-axis: Various state demographic attributes

Takeaways:

- We can see the same trends as in the the correlation plot, presented individually for each demographic attribute
- One added attribute is the permissive vs. restrictive gun laws rate, which seems to be strongly correlated with crude rates



Full model results

```
Call:
lm(formula = Crude.Rate ~ Total.Residents + size + Children.0.18 +
    Male + White + Black + Hispanic + Median.Annual.Household.Income +
    Unemployed + permissive_restrictive_rate + total_laws, data = state_corr_with_deaths_crude_rates)

Residuals:
    Min      1Q  Median      3Q     Max
-6.2855 -1.7696 -0.1976  2.1057  4.4010

Coefficients:
                                    Estimate       Std. Error t value
(Intercept)                   -133.02681007198   56.33407624311  -2.361
Total.Residents                 -0.00000037802    0.00000008733  -4.329
size                             0.00002142137    0.00000822760   2.604
Children.0.18                  -61.44278948165   30.31228247325  -2.027
Male                           331.49001471308  120.54970161272   2.750
White                            5.23533087376    6.16177881979   0.850
Black                           59.40857674078    9.55865863305   6.215
Hispanic                        22.24370998471    7.91915888582   2.809
Median.Annual.Household.Income  -0.00033905547    0.00005573871  -6.083
Unemployed                      41.68985690357   72.23282971695   0.577
permissive_restrictive_rate      6.78649270903    2.38665189548   2.844
total_laws                       0.13714622156    0.07922153742   1.731
                                Pr(>|t|)
(Intercept)                     0.023297 *
Total.Residents                 0.000101 ***
size                            0.012982 *
Children.0.18                   0.049538 *
Male                            0.008991 **
White                           0.400708
Black                          0.000000260 ***
Hispanic                        0.007730 **
Median.Annual.Household.Income 0.000000397 ***
Unemployed                      0.567149
permissive_restrictive_rate     0.007068 **
total_laws                      0.091326 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 3.036 on 39 degrees of freedom
Multiple R-squared:  0.8404,    Adjusted R-squared:  0.7954
F-statistic: 18.67 on 11 and 39 DF,  p-value: 0.000000000002997
```