# Protest by City Analysis

2025-03-24

## Load and Clean Data

```
ProtestByCity <- read.csv("/Users/aricaschuett/Documents/protest/ProtestByCity3-24.csv", row.names = NU

# Replace NAs with zero for selected variables
vars_to_replace <- c("AntiTrumpProtestPreGFCount", "ProtestTotal", "BlackVictimCount", "VictimCountPreG

ProtestByCity[vars_to_replace] <- ProtestByCity[vars_to_replace] %>%
  mutate(across(everything(), ~replace_na(.x, 0)))
```

## Create New Variables

```
ProtestByCity <- ProtestByCity %>%
  mutate(PoliceDeathsRate = VictimCountPreGF / population,
         BlackVictimsRate = BlackVictimCountPreGF / population,
         VictimRaceRatio = BlackVictimCountPreGF / VictimCountPreGF)
```

## Summaries

```
summary(ProtestByCity$BlackPovRate)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
##   0.000   0.946   1.000   0.893   1.000   1.000    4358
```

```
table(ProtestByCity$BlackPop == 0)
```

```
##
## FALSE  TRUE
## 15391  4358
```

```
### Create Summary Tables for Cities with Protest and those without
NoProtestCities <- ProtestByCity %>%
  filter(PostGFProtestCount == 0)

summary(NoProtestCities$population)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     501     963    1967    5090    4722  617790
```

```
summary(NoProtestCities$BlackPopPct)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## 0.00000 0.00000 0.01290 0.08319 0.06667 1.00000
```

```
summary(NoProtestCities$EduRate)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.    NA's
```

```
##  0.0000  0.1241  0.1892  0.2365  0.3020  1.0000       3
```

```
summary(NoProtestCities$CollegeStudents)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     0.0    25.0    63.0   250.8   193.0 29984.0
```

```
summary(NoProtestCities$AntiTrumpProtestPreGFCount)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.0000  0.0000  0.0000  0.2003  0.0000 28.0000
```

```
summary(NoProtestCities$VictimsCount)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## 0.00000 0.00000 0.00000 0.02595 0.00000 9.00000
```

```
ProtestCities <- ProtestByCity %>%
  filter(PostGFProtestCount > 0)

summary(ProtestCities$population)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     505    5891   15354   46648   39894 8419316
```

```
summary(ProtestCities$BlackPopPct)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## 0.00000 0.01296 0.03965 0.10149 0.11755 0.97372
```

```
summary(ProtestCities$EduRate)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.0192  0.2000  0.2880  0.3323  0.4329  0.9356
```

```
summary(ProtestCities$CollegeStudents)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##      0.0    207.8    729.0   3168.3   2474.2 469139.0
```

```
summary(ProtestCities$AntiTrumpProtestPreGFCount)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##   0.000   0.000   2.000   7.663   6.000 767.000
```

```
summary(ProtestCities$VictimsCount)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.0000  0.0000  0.0000  0.7348  1.0000 61.0000
```

## Regression Models

### Model 8

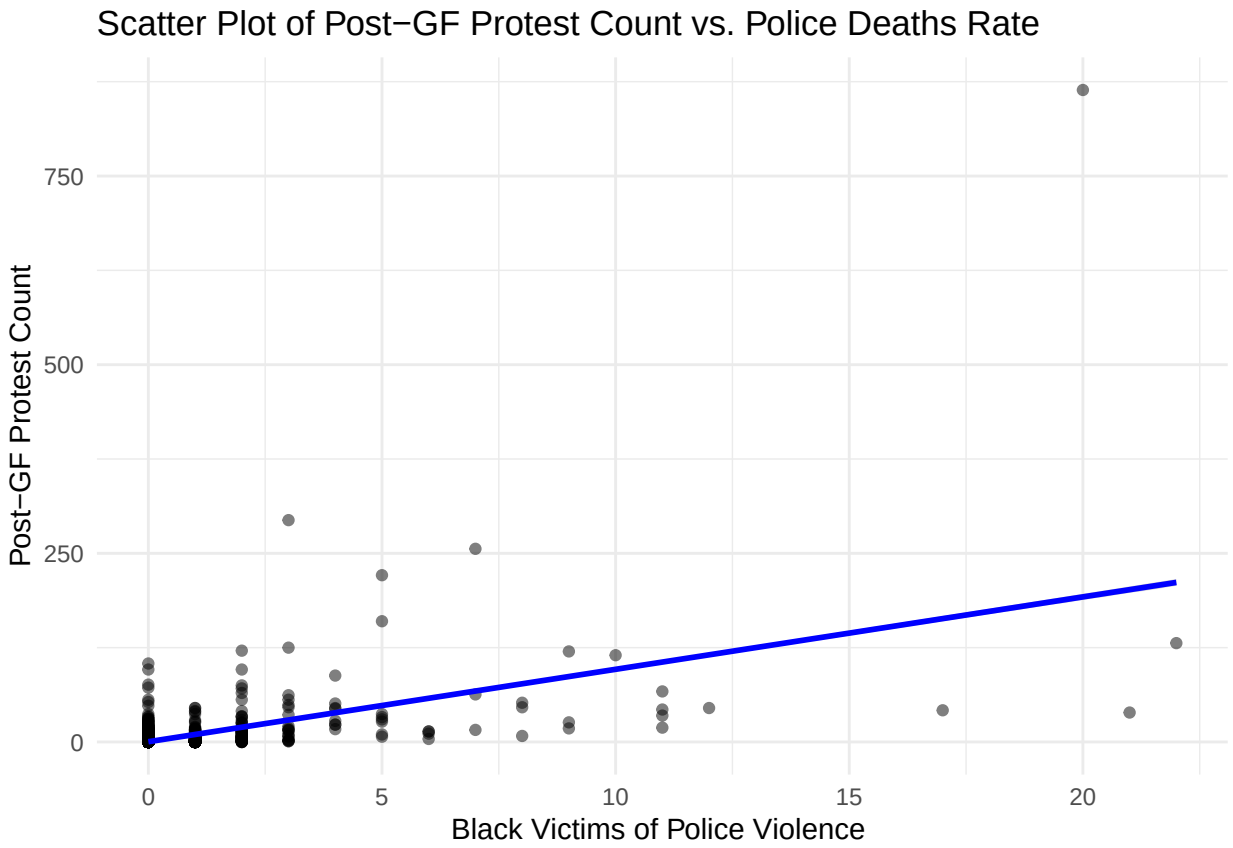
```
m8 <- lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + AntiTrumpProtestPreGF
summary(m8)
```

```
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + AntiTrumpProtestPreGFCount + PoliceDeathsRate,
```

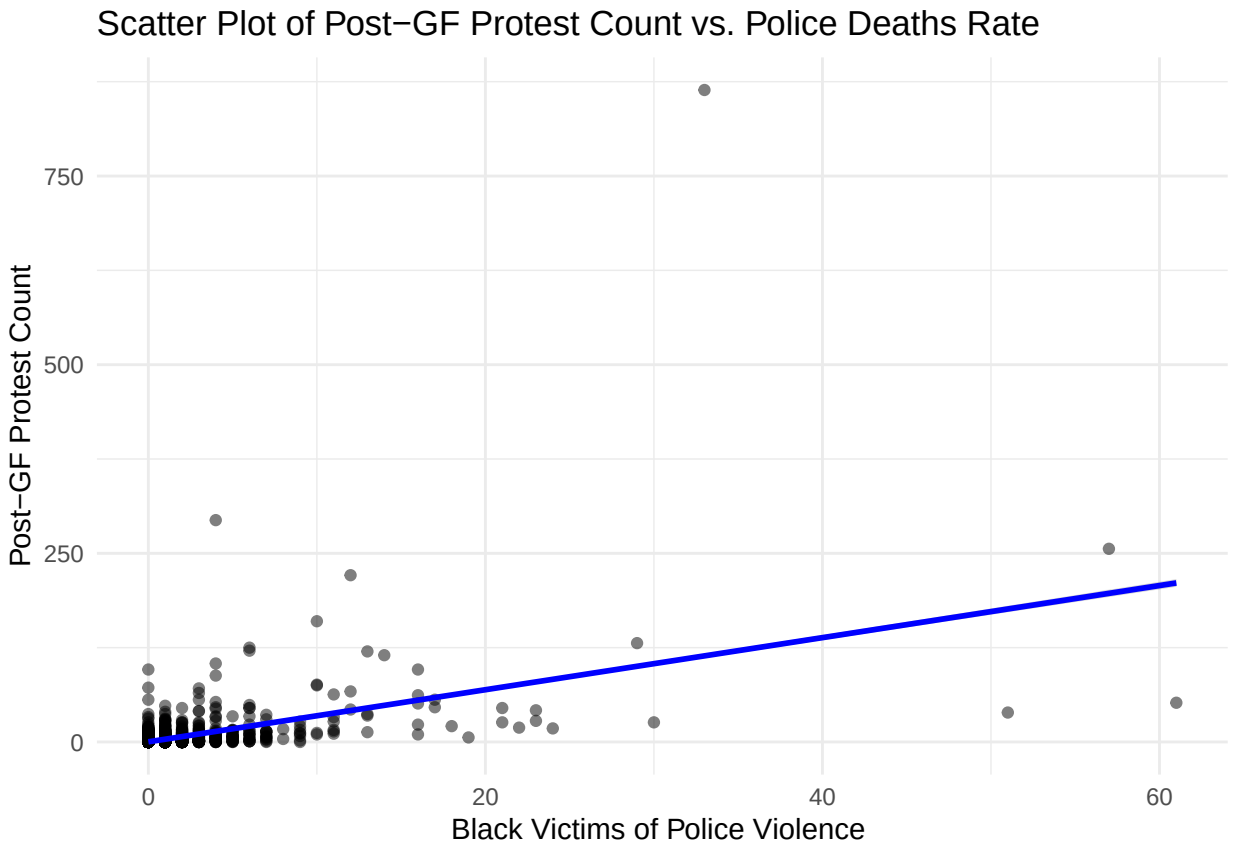
```
##     data = ProtestByCity)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -114.056   -0.095    0.205    0.349  222.729
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 1.576e-01  1.235e-01   1.276  0.20207
## population                  4.666e-05  5.459e-07  85.486  < 2e-16 ***
## BlackPopPct                -2.376e-01  1.720e-01  -1.381  0.16731
## BlackPovRate               -3.285e-01  1.249e-01  -2.631  0.00852 **
## EduRate                    -8.954e-01  1.833e-01  -4.884 1.05e-06 ***
## AntiTrumpProtestPreGFCount  3.246e-01  3.997e-03  81.218  < 2e-16 ***
## PoliceDeathsRate           -5.992e+02  7.059e+02  -0.849  0.39603
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.781 on 15381 degrees of freedom
##   (4361 observations deleted due to missingness)
## Multiple R-squared:  0.8233, Adjusted R-squared:  0.8233
## F-statistic: 1.195e+04 on 6 and 15381 DF,  p-value: < 2.2e-16
```

## Descriptive Plots

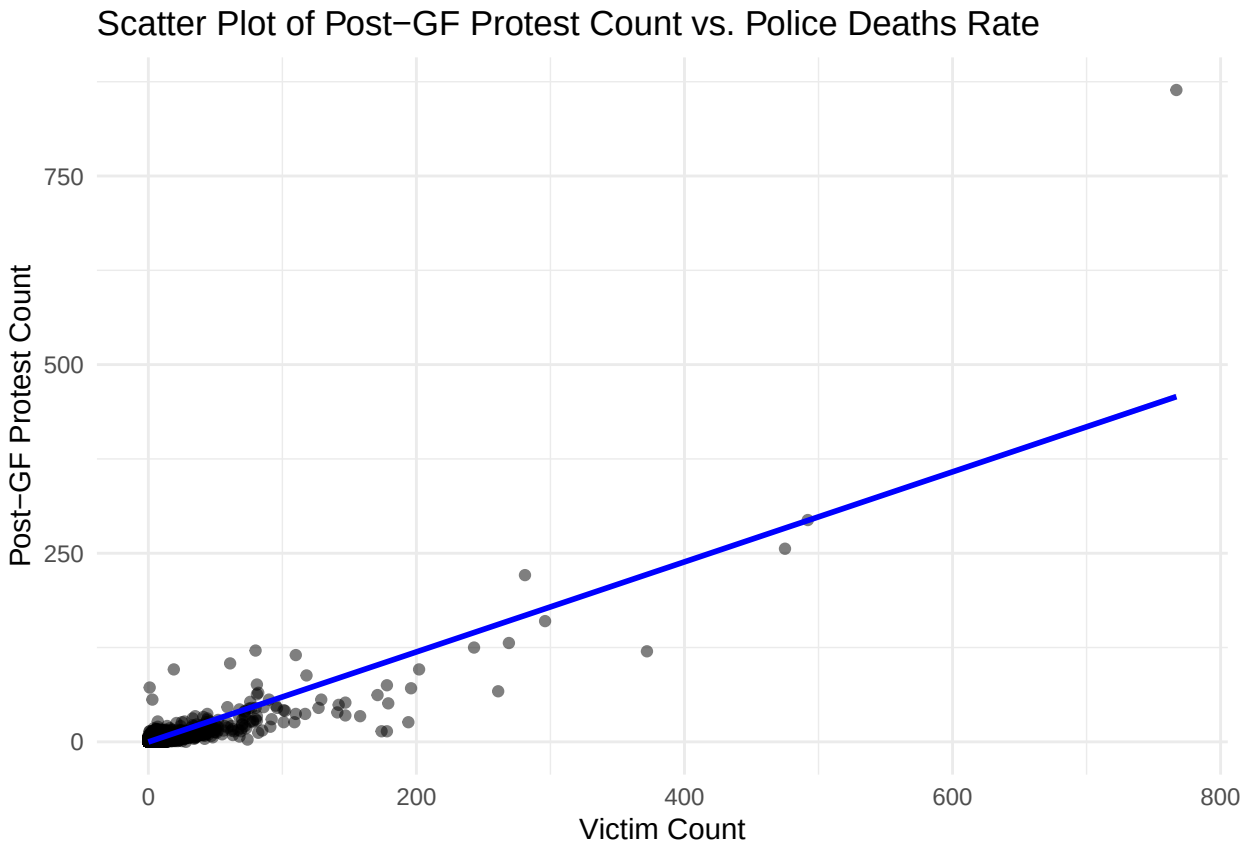
```
p1 <- ggplot(ProtestByCity, aes(x = BlackVictimCountPreGF, y = PostGFProtestCount)) +
  geom_point(alpha = 0.5) +
  geom_smooth(method = "lm", se = TRUE, color = "blue") +
  labs(title = "Scatter Plot of Post-GF Protest Count vs. Police Deaths Rate",
       x = "Black Victims of Police Violence ",
       y = "Post-GF Protest Count") +
  theme_minimal()
p1
```




```
p2 <- ggplot(ProtestByCity, aes(x = VictimsCount, y = PostGFProtestCount)) +
  geom_point(alpha = 0.5) +
  geom_smooth(method = "lm", se = TRUE, color = "blue") +
  labs(title = "Scatter Plot of Post-GF Protest Count vs. Police Deaths Rate",
       x = "Black Victims of Police Violence ",
       y = "Post-GF Protest Count") +
  theme_minimal()
p2
```




```
p3 <- ggplot(ProtestByCity, aes(x = AntiTrumpProtestPreGFCount, y = PostGFProtestCount)) +
  geom_point(alpha = 0.5) +
  geom_smooth(method = "lm", se = TRUE, color = "blue") +
  labs(title = "Scatter Plot of Post-GF Protest Count vs. Police Deaths Rate",
       x = "Victim Count",
       y = "Post-GF Protest Count") +
  theme_minimal()
p3
```




### Model 9

```
m9 <- lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + BlackVictimsRate, data
summary(m9)
```

```
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + BlackVictimsRate, data = ProtestByCity)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -150.903   -0.299    0.157    0.359  237.174
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)       6.974e-02  1.475e-01   0.473   0.6364
## population        8.234e-05  3.874e-07 212.547  < 2e-16 ***
## BlackPopPct       9.907e-02  2.061e-01   0.481   0.6308
## BlackPovRate     -5.963e-01  1.492e-01  -3.997 6.45e-05 ***
## EduRate           4.117e-01  2.183e-01   1.886   0.0593 .
## BlackVictimsRate  1.440e+03  2.605e+03   0.553   0.5804
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.519 on 15382 degrees of freedom
##   (4361 observations deleted due to missingness)
## Multiple R-squared:  0.7476, Adjusted R-squared:  0.7475
```

```
## F-statistic:  9110 on 5 and 15382 DF,  p-value: < 2.2e-16
```

### Model 10

```
m10 <- lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + VictimRaceRatio, data
summary(m10)
```

```
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + VictimRaceRatio, data = ProtestByCity)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -153.890   -2.915    0.133    2.707  232.033
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)      8.797e-01  2.621e+00   0.336 0.737169
## population       8.377e-05  1.334e-06  62.784  < 2e-16 ***
## BlackPopPct      5.561e+00  2.828e+00   1.967 0.049446 *
## BlackPovRate    -7.093e+00  2.795e+00  -2.538 0.011278 *
## EduRate          1.142e+01  2.963e+00   3.852 0.000123 ***
## VictimRaceRatio  8.451e-01  1.246e+00   0.678 0.497677
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 14.73 on 1209 degrees of freedom
##   (18534 observations deleted due to missingness)
## Multiple R-squared:  0.7715, Adjusted R-squared:  0.7706
## F-statistic: 816.5 on 5 and 1209 DF,  p-value: < 2.2e-16
```

### Additional Models (11-19)

For brevity, additional models are summarized below:

```
models <- list(
  m11 = lm(PostGFProtestCount ~ population + BlackPop + BlackPov + CollegeEdTotal + VictimCountPreGF, da
  m12 = lm(PostGFProtestCount ~ population + BlackPop + BlackPov + CollegeEdTotal + VictimsPreGF2020, da
  m13 = lm(PostGFProtestCount ~ population + BlackPop + BlackPov + CollegeEdTotal + VictimsPreGF2020Blk
  m14 = lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + VictimCountPreGF, da
  m15 = lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + BlackVictimCountPre
  m16 = lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + PoliceDeathsRate, da
  m17 = lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + BlackVictimsRate, da
  m18 = lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + VictimRaceRatio, dat
  m19 = lm(PostGFProtestCount ~ population + BlackPopPct + BlackPovRate + EduRate + AntiTrumpProtestPre
)

# Display summaries
lapply(models, summary)
```

```
## $m11
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPop + BlackPov +
```

```
##     CollegeEdTotal + VictimCountPreGF, data = ProtestByCity)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -130.468   -0.167    0.014    0.057  172.062
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)      -6.010e-02  2.458e-02  -2.445   0.0145 *
## population       -2.562e-05  1.925e-06 -13.312   <2e-16 ***
## BlackPop          1.004e-03  1.072e-04   9.365   <2e-16 ***
## BlackPov         -9.271e-04  1.097e-04  -8.453   <2e-16 ***
## CollegeEdTotal    3.709e-04  5.990e-06  61.915   <2e-16 ***
## VictimCountPreGF -7.914e-01  3.673e-02 -21.548   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.367 on 19743 degrees of freedom
## Multiple R-squared:  0.8206, Adjusted R-squared:  0.8206
## F-statistic: 1.806e+04 on 5 and 19743 DF,  p-value: < 2.2e-16
##
##
## $m12
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPop + BlackPov +
##     CollegeEdTotal + VictimsPreGF2020, data = ProtestByCity)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -135.050   -0.161    0.007    0.046  167.498
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)       -3.544e-02  2.462e-02  -1.439     0.15
## population        -3.961e-05  1.655e-06 -23.930  < 2e-16 ***
## BlackPop           8.886e-04  1.070e-04   8.307  < 2e-16 ***
## BlackPov          -7.971e-04  1.094e-04  -7.288 3.25e-13 ***
## CollegeEdTotal     3.980e-04  5.646e-06  70.490  < 2e-16 ***
## VictimsPreGF2020 -3.103e+00  1.654e-01 -18.764  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.377 on 19743 degrees of freedom
## Multiple R-squared:  0.8196, Adjusted R-squared:  0.8195
## F-statistic: 1.794e+04 on 5 and 19743 DF,  p-value: < 2.2e-16
##
##
## $m13
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPop + BlackPov +
##     CollegeEdTotal + VictimsPreGF2020Blk, data = ProtestByCity)
##
```

```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -135.693   -0.150    0.013    0.053  162.674
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)         -3.280e-02  2.464e-02  -1.331    0.183
## population          -4.889e-05  1.560e-06 -31.344  < 2e-16 ***
## BlackPop             9.205e-04  1.073e-04   8.579  < 2e-16 ***
## BlackPov            -8.141e-04  1.096e-04  -7.429 1.14e-13 ***
## CollegeEdTotal       4.197e-04  5.478e-06  76.613  < 2e-16 ***
## VictimsPreGF2020Blk -5.916e+00  3.247e-01 -18.220  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.378 on 19743 degrees of freedom
## Multiple R-squared:  0.8194, Adjusted R-squared:  0.8194
## F-statistic: 1.792e+04 on 5 and 19743 DF,  p-value: < 2.2e-16
##
##
## $m14
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + VictimCountPreGF, data = ProtestByCity)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -106.746   -0.408    0.050    0.280  232.548
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)        1.050e-01  1.383e-01   0.760   0.4474
## population         9.967e-05  5.222e-07 190.884  < 2e-16 ***
## BlackPopPct        3.517e-01  1.927e-01   1.826   0.0679 .
## BlackPovRate      -5.587e-01  1.398e-01  -3.996 6.48e-05 ***
## EduRate            2.907e-01  2.046e-01   1.421   0.1555
## VictimCountPreGF -1.873e+00  4.057e-02 -46.161  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.236 on 15382 degrees of freedom
##   (4361 observations deleted due to missingness)
## Multiple R-squared:  0.7783, Adjusted R-squared:  0.7782
## F-statistic: 1.08e+04 on 5 and 15382 DF,  p-value: < 2.2e-16
##
##
## $m15
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + BlackVictimCountPreGF, data = ProtestByCity)
##
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max
## -134.189   -0.310    0.139    0.374  237.663
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)            3.833e-02  1.466e-01   0.261   0.7938
## population             8.732e-05  5.255e-07 166.183  < 2e-16 ***
## BlackPopPct            4.057e-01  2.054e-01   1.976   0.0482 *
## BlackPovRate          -6.061e-01  1.483e-01  -4.088 4.37e-05 ***
## EduRate                4.116e-01  2.169e-01   1.897   0.0578 .
## BlackVictimCountPreGF -1.345e+00  9.667e-02 -13.909  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.491 on 15382 degrees of freedom
##   (4361 observations deleted due to missingness)
## Multiple R-squared:  0.7507, Adjusted R-squared:  0.7506
## F-statistic:  9263 on 5 and 15382 DF,  p-value: < 2.2e-16
##
##
## $m16
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + PoliceDeathsRate, data = ProtestByCity)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -150.895   -0.298    0.160    0.363  237.180
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)       6.170e-02  1.476e-01   0.418    0.676
## population        8.234e-05  3.874e-07 212.554  < 2e-16 ***
## BlackPopPct       1.016e-01  2.056e-01   0.494    0.621
## BlackPovRate     -5.937e-01  1.492e-01  -3.980 6.94e-05 ***
## EduRate           4.155e-01  2.183e-01   1.903    0.057 .
## PoliceDeathsRate  1.003e+03  8.435e+02   1.189    0.234
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.519 on 15382 degrees of freedom
##   (4361 observations deleted due to missingness)
## Multiple R-squared:  0.7476, Adjusted R-squared:  0.7475
## F-statistic:  9111 on 5 and 15382 DF,  p-value: < 2.2e-16
##
##
## $m17
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + BlackVictimsRate, data = ProtestByCity)
##
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max
## -150.903   -0.299    0.157    0.359  237.174
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)       6.974e-02  1.475e-01   0.473   0.6364
## population        8.234e-05  3.874e-07 212.547  < 2e-16 ***
## BlackPopPct       9.907e-02  2.061e-01   0.481   0.6308
## BlackPovRate     -5.963e-01  1.492e-01  -3.997 6.45e-05 ***
## EduRate           4.117e-01  2.183e-01   1.886   0.0593 .
## BlackVictimsRate  1.440e+03  2.605e+03   0.553   0.5804
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.519 on 15382 degrees of freedom
##   (4361 observations deleted due to missingness)
## Multiple R-squared:  0.7476, Adjusted R-squared:  0.7475
## F-statistic:  9110 on 5 and 15382 DF,  p-value: < 2.2e-16
##
##
## $m18
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + VictimRaceRatio, data = ProtestByCity)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -153.890   -2.915    0.133    2.707  232.033
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)       8.797e-01  2.621e+00   0.336 0.737169
## population        8.377e-05  1.334e-06  62.784  < 2e-16 ***
## BlackPopPct       5.561e+00  2.828e+00   1.967 0.049446 *
## BlackPovRate     -7.093e+00  2.795e+00  -2.538 0.011278 *
## EduRate           1.142e+01  2.963e+00   3.852 0.000123 ***
## VictimRaceRatio   8.451e-01  1.246e+00   0.678 0.497677
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 14.73 on 1209 degrees of freedom
##   (18534 observations deleted due to missingness)
## Multiple R-squared:  0.7715, Adjusted R-squared:  0.7706
## F-statistic: 816.5 on 5 and 1209 DF,  p-value: < 2.2e-16
##
##
## $m19
##
## Call:
## lm(formula = PostGFProtestCount ~ population + BlackPopPct +
##     BlackPovRate + EduRate + AntiTrumpProtestPreGFCount + VictimRaceRatio,
##     data = ProtestByCity)
##
```

```
## Residuals:
##      Min       1Q   Median       3Q      Max
## -114.353   -1.387    1.219    2.729  206.838
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  2.325e+00  2.151e+00   1.081   0.2800
## population                   4.592e-05  1.907e-06  24.078   <2e-16 ***
## BlackPopPct                  1.298e+00  2.327e+00   0.558   0.5771
## BlackPovRate                -4.961e+00  2.295e+00  -2.161   0.0309 *
## EduRate                     -1.341e+00  2.488e+00  -0.539   0.5900
## AntiTrumpProtestPreGFCount   3.570e-01  1.473e-02  24.231   <2e-16 ***
## VictimRaceRatio             -8.907e-01  1.025e+00  -0.869   0.3850
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 12.09 on 1208 degrees of freedom
##   (18534 observations deleted due to missingness)
## Multiple R-squared:  0.8463, Adjusted R-squared:  0.8455
## F-statistic:  1108 on 6 and 1208 DF,  p-value: < 2.2e-16
```

---