Story3

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Story -3 : Do stricter gun laws reduce firearm gun deaths?

The CDC publishes firearm mortality for each State per 100,000 persons https://www.cdc.gov/nchs/pressroom/sosmap/firearm_mortality/firearm.htm. Each State' firearm control laws can be categorized as very strict to very lax. The purpose of this Story is to answer the question, " Do stricter firearm control laws help reduce firearm mortality?"

For this assignment you will need to:

- Access the firearm mortality data from the CDC using an available API (https://open.cdc.gov/apis.html)
- Create a 5 point Likert scale categorizing gun control laws from most lax to strictest and assign each state to the most appropriate Likert bin.
- Determine whether stricter gun control laws result in reduced gun violence deaths
- Present your story using heat maps

Load libraries required for this project

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.3     v tidyr     1.3.1
## v purrr     1.0.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(openintro)
```

```
## Loading required package: airports
## Loading required package: cherryblossom
## Loading required package: usdata
```

```r
library(httr)
library(jsonlite)
```

```
##
## Attaching package: 'jsonlite'
##
## The following object is masked from 'package:purrr':
##
##     flatten
```

```r
library(plotly)
```

```
##
## Attaching package: 'plotly'
##
## The following object is masked from 'package:httr':
##
##     config
##
## The following object is masked from 'package:ggplot2':
##
##     last_plot
##
## The following object is masked from 'package:stats':
##
##     filter
##
## The following object is masked from 'package:graphics':
##
##     layout
```

```r
library(rvest)
```

```
##
## Attaching package: 'rvest'
##
## The following object is masked from 'package:readr':
##
##     guess_encoding
```

Loading firearm mortality dataset Data extracted from the CDC website

```r
# Set JSON data URL
url <- "https://data.cdc.gov/resource/489q-934x.json"

# Use GET request function to get data
response_data <- GET(url)

# convert URL response to a list
list_data <- fromJSON(content(response_data, "text", encoding = "UTF-8"))
```

```r
# Convert list to data frame
mortality_data <- as.data.frame(list_data)

# display data
head(mortality_data)
```

```
##   year_and_quarter                   time_period
## 1          2022 Q1 12 months ending with quarter
## 2          2022 Q1 12 months ending with quarter
## 3          2022 Q1 12 months ending with quarter
## 4          2022 Q1 12 months ending with quarter
## 5          2022 Q1 12 months ending with quarter
## 6          2022 Q1 12 months ending with quarter
##                         cause_of_death    rate_type               unit
## 1                           All causes Age-adjusted Deaths per 100,000
## 2                    Alzheimer disease Age-adjusted Deaths per 100,000
## 3                             COVID-19 Age-adjusted Deaths per 100,000
## 4                               Cancer Age-adjusted Deaths per 100,000
## 5 Chronic liver disease and cirrhosis Age-adjusted Deaths per 100,000
## 6  Chronic lower respiratory diseases Age-adjusted Deaths per 100,000
##   rate_overall rate_sex_female rate_sex_male rate_alaska rate_alabama
## 1        873.2           729.4          1038       944.5       1109.8
## 2         30.6              35          23.8        28.5         45.5
## 3           95            75.2         119.1       121.3        133.6
## 4        145.9           127.4         170.9         156        159.9
## 5         14.4            10.3          18.9        25.5         16.4
## 6         35.1            33.2          37.8        36.4         51.7
##   rate_arkansas rate_arizona rate_california rate_colorado rate_connecticut
## 1        1097.1        882.5           719.5         808.2            725.9
## 2          43.2         29.6            38.4          32.1             21.6
## 3         123.6        113.9            62.4          89.9             50.9
## 4         167.9        134.5           131.4           125            134.1
## 5            17           21            15.4          19.7             12.5
## 6          62.3           37            26.3          38.1             23.9
##   rate_district_of_columbia rate_delaware rate_florida rate_georgia rate_hawaii
## 1                     844.4         868.3          828        973.6       647.1
## 2                      10.7          30.1         19.3         43.4        23.6
## 3                      54.8          78.4        106.6        116.4        43.9
## 4                     143.8         155.4        141.3        150.4       126.7
## 5                       9.1          11.5         13.4         13.7         9.7
## 6                      17.7          36.5         32.1         41.1        17.9
##   rate_iowa rate_idaho rate_illinois rate_indiana rate_kansas rate_kentucky
## 1     860.8      892.8         839.4       1011.9       938.4        1153.2
## 2      30.9       41.5          26.6         29.6        22.9          32.5
## 3      78.1      118.9          82.1        112.1       109.7         146.7
## 4       152      139.6         149.3          169       152.8         179.6
## 5      14.3       16.1          12.3         15.4        15.4          17.2
## 6      40.8       44.1          32.4         52.9        43.8          58.3
##   rate_louisiana rate_massachusetts rate_maryland rate_maine rate_michigan
## 1         1084.4               717         800.3      910.3         956.2
## 2           42.8              17.5          15.9       28.1          34.1
## 3          108.8              46.7          66.9       70.9           115
## 4          161.9             136.1         139.2      161.2         159.6
```

```
## 5           12.1               11.1           9.3       17.8          15.1
## 6           39.6               26.8          24.1       43.1            39
##   rate_minnesota rate_missouri rate_mississippi rate_montana
## 1          771.6         986.6           1193.4        925.3
## 2           34.1          33.5             51.8         24.4
## 3             68         110.5            140.8        111.8
## 4          143.6         162.4              184        142.9
## 5           13.6          13.1             17.3         24.7
## 6           30.1          46.7             59.9         39.6
##   rate_north_carolina rate_north_dakota rate_nebraska rate_new_hampshire
## 1               952.8             810.5         839.4              791.9
## 2                  36              32.5          29.8               23.3
## 3                98.3              80.2          73.8               56.5
## 4               152.4             134.2         152.2              145.3
## 5                  15              17.8          15.2               14.5
## 6                37.3              35.4            41                 36
##   rate_new_jersey rate_new_mexico rate_nevada rate_new_york rate_ohio
## 1           723.5          1007.9       933.3         694.4    1019.8
## 2            20.5            25.4        26.3          12.8        34
## 3            62.9           138.3       134.8          63.4     128.1
## 4           130.3           135.6       140.8         125.3     161.5
## 5             8.9            41.8        17.6           8.3      14.1
## 6            21.6            38.3        41.4          22.5        43
##   rate_oklahoma rate_oregon rate_pennsylvania rate_rhode_island
## 1        1126.4       875.6              893.5               771
## 2          37.1          40               22.5              28.3
## 3         150.3        77.5               97.4              55.5
## 4         176.7       153.7              151.8             139.1
## 5          19.3          18                 11              16.8
## 6          63.5        34.1               30.8              29.4
##   rate_south_carolina rate_south_dakota rate_tennessee rate_texas rate_utah
## 1                1022             871.4         1122.6      918.3     822.2
## 2                40.1              39.1           37.2       41.2        41
## 3               122.9              76.3          140.5      126.7      78.4
## 4               154.3             148.6          165.2      143.5     120.6
## 5                17.5              36.1           17.1       16.8      11.6
## 6                41.6              41.6             52       36.2      30.6
##   rate_virginia rate_vermont rate_washington rate_wisconsin rate_west_virginia
## 1         860.1        800.5           811.1          857.1             1239.9
## 2          26.1         36.2              46           33.6               35.4
## 3          80.8         32.9            66.6           77.7                154
## 4         149.8          155           148.5          146.7              183.8
## 5          11.7         12.6            15.5           12.5               17.9
## 6          31.3         32.4            29.5           33.2               59.9
##   rate_wyoming rate_age_1_4 rate_age_5_14 rate_age_15_24 rate_age_25_34
## 1        956.8         <NA>          <NA>           <NA>           <NA>
## 2         34.2         <NA>          <NA>           <NA>           <NA>
## 3        145.1         <NA>          <NA>           <NA>           <NA>
## 4        153.1         <NA>          <NA>           <NA>           <NA>
## 5           25         <NA>          <NA>           <NA>           <NA>
## 6         49.5         <NA>          <NA>           <NA>           <NA>
##   rate_age_35_44 rate_age_45_54 rate_age_55_64 rate_65_74 rate_age_75_84
## 1           <NA>           <NA>           <NA>       <NA>           <NA>
## 2           <NA>           <NA>           <NA>       <NA>           <NA>
```

```
## 3           <NA>           <NA>           <NA>       <NA>           <NA>
## 4           <NA>           <NA>           <NA>       <NA>           <NA>
## 5           <NA>           <NA>           <NA>       <NA>           <NA>
## 6           <NA>           <NA>           <NA>       <NA>           <NA>
##   rate_age_85_plus
## 1             <NA>
## 2             <NA>
## 3             <NA>
## 4             <NA>
## 5             <NA>
## 6             <NA>
```

Analyze and filter data for this scenario Filter data to obtain only the necessary columns for this analysis, I'm going to work with the last quarter of last year(2023) for this scenario

```r
#Filtering the data
mortality_gun <- mortality_data[mortality_data$cause_of_death == "Firearm-related injury" & mortality_da

mortality_gun <- data.frame(mortality_gun, row.names = NULL)

#Abbreviate state names
abbre_state <- c(AL = "alabama", AK = "alaska", AZ = "arizona", AR = "arkansas", CA = "california", CO =
#Loop through each state to remove "rate_"
for (abbrev in names(abbre_state)) {
  pattern <- paste0("rate_", abbre_state[abbrev])
  colnames(mortality_gun ) <- gsub(pattern, abbrev, colnames(mortality_gun ))
}

#Convert string columns from char to double columns 6 to 69
mortality_gun <- mortality_gun %>%
  mutate(across(.cols = 6:69, .fns = as.double))
#Group by year
mortality_gun <- mortality_gun %>%
  mutate(year = substr(year_and_quarter, 1, 4)) %>%
  group_by(year)
#Select last Quarter of 2023
mortality_gun_2023 <- mortality_gun %>%
  filter(year_and_quarter == "2023 Q4")
#Pivoting Long
df_gun_2023_long <- mortality_gun_2023 %>%
  pivot_longer (
    cols = c(AK:WY),
    names_to = "state",
    values_to = "rate"
  )
# reorder columns
final_gun <- df_gun_2023_long %>%
  select(year, state, rate)
# Add an ID column
final_gun$ID <- seq_along(final_gun$year)
#reorder columns
final_gun <- final_gun[, c("ID", "year", "state", "rate")]
# final result
```

```r
head(final_gun)
```

```
## # A tibble: 6 x 4
## # Groups:   year [1]
##      ID year  state  rate
##   <int> <chr> <chr> <dbl>
## 1     1 2023  AK     24
## 2     2 2023  AL     25.3
## 3     3 2023  AR     21.9
## 4     4 2023  AZ     19.1
## 5     5 2023  CA      8.2
## 6     6 2023  CO     17.3
```

Loading gun control laws dataset

Extracted from the law center score card, data scrapped from URL table

```r
# URL of the website
url <- "https://giffords.org/lawcenter/resources/scorecard/"

# Read the HTML code of the page
html_code <- read_html(url)

# Use the html_nodes function to extract the table
law_html <- html_code %>% html_nodes("table") %>% .[[1]]

# Use the html_table function to convert the table
# HTML code into a data frame
law_df <- law_html %>% html_table()

# Inspect the first few rows of the data frame
head(law_df)
```

```
## # A tibble: 6 x 5
##   `Gun Law Strength\n`                          `~1` `State Grade` `Gun Death Rate\n    ~2`
##   <chr>                                         <chr> <chr>         <chr>
## 1 35                                            Alab~ F             4
## 2 40                                            Alas~ F             7
## 3 41                                            Ariz~ F             12
## 4 48                                            Arka~ F             8
## 5 1                                             Cali~ A             44
## 6 10                                            Colo~ A-            19
## # i abbreviated names:
## #   1: `Gun Law Strength\n                                                    (Ranked)`,
## #   2: `Gun Death Rate\n                                                   (Ranked)`
## # i 1 more variable:
## #   `Gun Death Rate\n                                                  (per 100K)` <chr>
```

Remove columns to keep only the columns need it for the analysis.

```
#remove columns
remove_law <- c(
  "Gun Law Strength
                                                    (Ranked)", "Gun Death Rate
                                                    (Ranked)" ,"Gun Death Rate
                                                    (per 100K)", "X"
)
# Subset the data frame to exclude specific columns
law_df1<- law_df[, !names(law_df) %in% remove_law]

# Remove last row of dataset
law_df2 <- law_df1[-51,]
# create ID column to merge datasets
law_df2$ID <- seq_along(law_df2$Grade)
# Reorder the columns
law_df2 <- law_df2[, c("ID","State", "Grade")]
# Convert data into dataframe
law_df2 <- data.frame(law_df2, row.names = NULL)
# Print the updated data frame
head(law_df2)
```

```
##   ID      State Grade
## 1  1    Alabama     F
## 2  2     Alaska     F
## 3  3    Arizona     F
## 4  4   Arkansas     F
## 5  5 California     A
## 6  6   Colorado    A-
```

Convert values of Grade column into integer.

```
final_law <- law_df2 %>%
  mutate(Grade = case_when(
      Grade == "F" ~ "1",
      Grade == "D+" ~ "2",
      Grade == "D-" ~ "2",
      Grade == "C+" ~ "3",
      Grade == "C-" ~ "3",
      Grade == "C" ~ "3",
      Grade == "B+" ~ "4",
      Grade == "B-" ~ "4",
      Grade == "B" ~ "4",
      Grade == "A-" ~ "5",
      Grade == "A" ~ "5",

      TRUE ~ Grade

    )
  )

final_law
```

```
##    ID          State Grade
```

```
## 1   1        Alabama     1
## 2   2         Alaska     1
## 3   3        Arizona     1
## 4   4       Arkansas     1
## 5   5     California     5
## 6   6       Colorado     5
## 7   7    Connecticut     5
## 8   8       Delaware     4
## 9   9        Florida     2
## 10 10        Georgia     1
## 11 11         Hawaii     5
## 12 12          Idaho     1
## 13 13       Illinois     5
## 14 14        Indiana     2
## 15 15           Iowa     1
## 16 16         Kansas     1
## 17 17       Kentucky     1
## 18 18      Louisiana     1
## 19 19          Maine     2
## 20 20       Maryland     5
## 21 21  Massachusetts     5
## 22 22       Michigan     4
## 23 23      Minnesota     4
## 24 24    Mississippi     1
## 25 25       Missouri     1
## 26 26        Montana     1
## 27 27       Nebraska     3
## 28 28         Nevada     4
## 29 29  New Hampshire     2
## 30 30     New Jersey     5
## 31 31     New Mexico     3
## 32 32       New York     5
## 33 33 North Carolina     3
## 34 34   North Dakota     1
## 35 35           Ohio     2
## 36 36       Oklahoma     1
## 37 37         Oregon     5
## 38 38   Pennsylvania     4
## 39 39   Rhode Island     4
## 40 40 South Carolina     2
## 41 41   South Dakota     1
## 42 42      Tennessee     1
## 43 43          Texas     1
## 44 44           Utah     1
## 45 45        Vermont     4
## 46 46       Virginia     4
## 47 47     Washington     5
## 48 48  West Virginia     1
## 49 49      Wisconsin     3
## 50 50        Wyoming     1
```

Merge both Datasets to create visualizations

```r
# insert values manually for more data accuracy
gunstats_df <- final_gun %>%
  mutate(
    grade = case_when(
      state %in% c("AL","AK","AZ","AR","GA","ID","IA","KS","KY","LA","MO","MS","MT","ND","OK","SD","TN"
      state  %in% c("FL","IN","ME","NH","OH","SC")~ "2",
      state %in% c("NE","NM","NC","WI") ~ "3",
      state %in% c("DE","MI","MN","NV","PA","RI","VT","VA") ~ "4",
      state %in% c("CA","CO","CT","DC","HI","IL","MD","MA","NJ","NY","OR","WA") ~ "5",
      TRUE ~ NA_character_
    )
  )
#convert new column to numeric values
gunstats_df$grade <- as.numeric(gunstats_df$grade)

# Final dataframe for graphics
gunstats_df
```

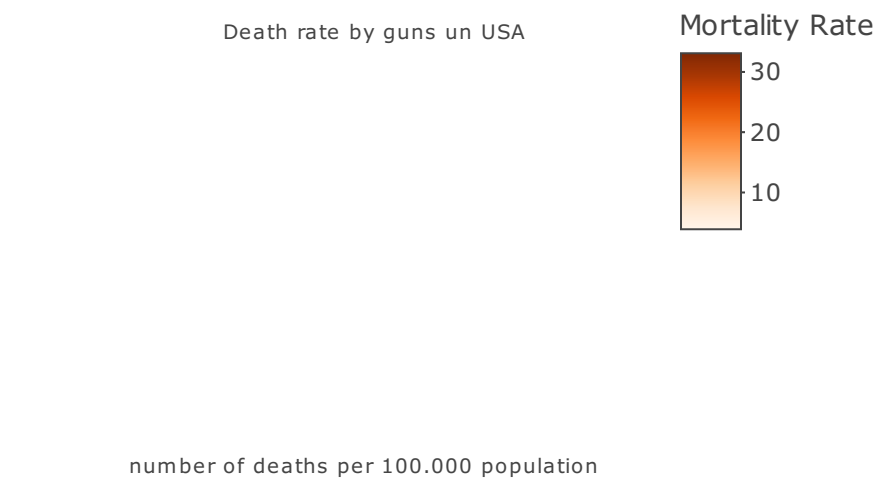
```
## # A tibble: 51 x 5
## # Groups:   year [1]
##       ID year  state  rate grade
##    <int> <chr> <chr> <dbl> <dbl>
##  1     1 2023  AK     24       1
##  2     2 2023  AL     25.3     1
##  3     3 2023  AR     21.9     1
##  4     4 2023  AZ     19.1     1
##  5     5 2023  CA      8.2     5
##  6     6 2023  CO     17.3     5
##  7     7 2023  CT      6.2     5
##  8     8 2023  DC     33.1     5
##  9     9 2023  DE     12       4
## 10    10 2023  FL     14.4     2
## # i 41 more rows
```

First heatmap displaying gun control laws and death rates by state, with mortality rate as likert scale reference.

```r
heatmap1 <- plot_geo(gunstats_df, locations = ~state, text = ~state, z = ~rate) %>%
  add_trace(
    type = "choropleth",
    colors = "Oranges",
    locationmode = "USA-states"
  ) %>%
  colorbar(title = "Mortality Rate") %>%
  layout(
    title = "2023 Last Quarter Death rate by firearms in USA",
    geo = list(
      scope = "usa",
      projection = list(type = "albers usa"),
      showlakes = TRUE,
      lakecolor = toRGB("white")
    ),
    annotations = list(
```

```
      list(
        x = 0.5,
        y = .95,
        xref = "paper",
        yref = "paper",
        text = "Death rate by guns un USA",
        showarrow = FALSE,
      font = list(size = 10)
    ),
      list(
        x = 0.05,
        y = 0.05,
        xref = "paper",
        yref = "paper",
      text = "number of deaths per 100.000 population",
      showarrow = FALSE,
       font = list(size = 10)

      )
    )
  )
heatmap1
```



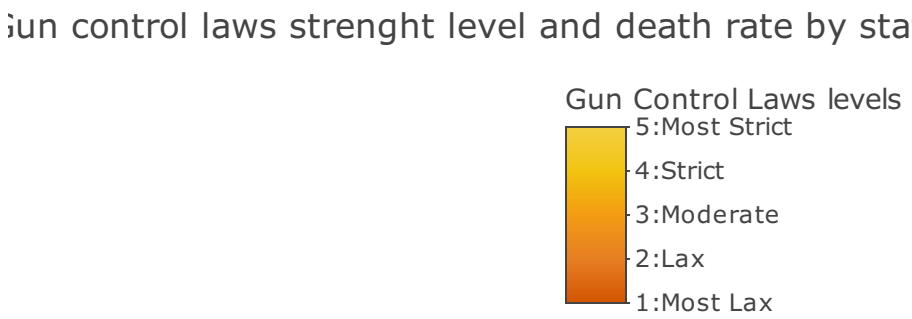
Second heatmap displays the gun control laws strength rating for each state with the mortality rate on it, with 1 as most lax to 5 as most strict.

```r
#Setting colors in a different variable, for gun control laws categories
category_colors <- c(
  "1" = "#d35400",   # most lax
  "2" = "#e67e22",   # lax
  "3" = "#f39c12",   # moderate
  "4" = "#f1c40f",   # strict
  "5" = "#f4d03f"    # most strict
)
```

```r
heatmap2 <- plot_geo(gunstats_df, locationmode = 'USA-states') %>%
  add_trace(
    z = gunstats_df$grade,
    locations = gunstats_df$state,
    color = gunstats_df$grade,
    colors = category_colors,
    text = ~paste("State: ",state, "<br>Grade: ",grade, "<br>Death Rate: ",rate),
    hoverinfo = "text"
  )
```

```r
heatmap2 <- heatmap2 %>%
  layout(
    title = "Gun control laws strenght level and death rate by states ",
    geo = list(
      scope = 'usa',
      projection = list(type = 'albers usa'),
      showlakes = TRUE,
      lakecolor = toRGB('white')
    )
  )
```

```r
heatmap2 <- heatmap2 %>%
  colorbar(
    title = "Gun Control Laws levels",
    tickvals = 1:5,
    ticktext = c("1:Most Lax", "2:Lax", "3:Moderate", "4:Strict", "5:Most Strict"),
    ticks = "outside"
  )
heatmap2
```



Conclussion.

Do stricter firearm control laws help reduce firearm mortality?

Based on the visualization, the answer is yes, stricter firearms laws reduce firearm mortality, states with most strict firearms laws such as California, New Jersey, and Colorado tends to have a lower gun death rate(per 100k) than other states such as Alabama, Arizona, and Georgia with the most lax gun control laws with higher gun death rate(per 100k)